PILOT PROJECT
OF
SEWERAGE SYSTEM DEVELOPMENT
IN
DKI JAKARTA

CHAPTER VIII:
TECHNICAL SPECIFICATIONS
AND DRAWINGS

DIVISION I
GENERAL REQUIREMENTS

October 2014

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DIVISION I: GENERAL REQUIREMENTS

This Specification shall apply to all Works under the Contract, including those designed by the Engineer and those to be designed by the Contractor.

Section 1 - General Requirements

1.1 Scope of the Work

The work to be carried out by the Contractor is specified as follows.

Description	Unit	Quantity
(1) Construction of Sewerage Pipeline Length of Pipeline is 962.9m in total. (286.6m between Shaft A and B, 676.3m between Shaft B and C)		
1) Pipe Installation		
Length of Micorotunneling Method between Shaft A and B	m	279.9
Length of Micorotunneling Method between Shaft B and C	m	669.6
2) Construction of Shaft and Manhole		
Shaft A	unit	1
Shaft B and Manhole B	unit	1
Shaft C	unit	1

The work shall be carried out in accordance with the Drawings of sewer main and manhole, the Specifications and the directions of PPK (committing officer) and/or the supervision consultant of the project (hereinafter called "the Engineer").

The Contractor has to deeply investigate soil condition, groundwater level, and surrounding environment at the location of drive shaft etc., in order to select an appropriate microtunneling technology. The construction work cannot make an impact to the neighboring private housing and others, and the alignment of sewer main cannot be allowed to occupy the private lot.

In addition, the Contractor must carry out the construction work, environmental measures, and safety control carefully during the construction.

Particular attention shall be given as the general obligations of the Contractor when working in the vicinity of existing utility services, street trees, and boundary of private lot.

1.2 Scope of the Specification

The Specification applicable to the Works comprises the following Division:

(a) Division I – Specification: General Requirements

(b) Division II – Specification: Civil Works

The Specification shall be read and construed in conjunction with the remaining part of the Contract.

This Division I: General Requirements shall apply to all of the above listed Divisions of the Specification, and prevail over any of the above listed Divisions of the Specification when interpreting any discrepancies between this Division and other Division.

Any matter not provided in the Specification shall be determined reasonably through consultation between the Engineer and the Contractor.

1.3 Bid and Contract Specifications

For the avoidance of doubt, the Specification issued as an integral part of the Bidding Documents shall become an integral part of the Contract, together with the addenda issued before submission of the Bids.

Unless otherwise expressly noted, all of the requirements of the Specification shall be deemed to have been considered by the Contractor in determining the Accepted Contract Amount.

In the absence of definite specifications or reference to a specifications or apparent silence of the Specifications and Plans as to any detail or the apparent omission of detailed description concerning materials, plant and workmanship, it shall be deemed as meaning that only the best general practice is to prevail and that only materials, plant and workmanship of first class quality are to be used. All interpretation of the Specifications and Plans shall be on the basis stated above. In addition, whenever this situation occurred, the Contractor shall forthwith notify the Engineer in writing, with a copy to the Employer, of the fact stating the absence of specification and proposed specification as well. It will be acceptable subject to the Employer's prior review and written approval.

1.4 Definitions

Except those additionally defined in the Specification and those specifically defined otherwise in the Specification, the words and expressions appearing in the Specification shall have the meanings stated in Sub-Clause 1 of the General Conditions.

1.5 Equivalency of Standard and codes

Wherever reference is made in the Contract to specific standards and codes, the provision of the latest current edition or revision of the relevant standards and codes in effect shall apply.

The standards and codes indicated in this document can be replaced by other standards in accordance with construction conditions in a particular country or region and shall be encouraged to be applied. However, the alternative standards shall ensure the quality equal or higher than the standards and codes specified.

Differences between the standards specified and the proposed alternative standards should be fully described in writing by the Contractor and submitted to the Engineer for approval at least twenty-eight (28) days prior to the date when the Contractor desires to use it.

Section 2 - Work Constraints

2.1 General

The Time for Completion of the Works and all programs prepared by the Contractor should include allowance for the following work constraints:

a. Condition and use of existing surrounding roads; and

b. Site area restrictions.

2.2 Condition and Use of Existing Surrounding Roads

The Contractor’s use of existing roads for hauling/delivery of materials is subject to the approval of the Employer. Such approval from the Employer does not relieve the Contractor of his obligations to the Contract. Contractor shall be responsible for maintaining,

liable for repairing of any damages incurred and restoration of the structures, not lesser than originally constructed, at his own cost.

2.3 Site Area Restrictions

Gas pipeline is existing in the vicinity of construction site (proposed site of shafts A). The Contractor shall detect the exact alignment of gas pipeline by careful exploratory excavation in advance and shall avoid the affection to it.

Section 3 - The Site

3.1 The site for construction work

The Site for the Works in three locations including the area of the shaft A, B and C is indicated on the Drawings with the Site boundaries. The area of the site is presented in following table.

Table Area of the Site

Name	Site for Shaft A	Site for Shaft B	Site for Shaft C
Area (m^2)	1,500	700	1,450

The Contractor shall be responsible for the safety, the environment and the reinstatement of the existing structures affected by the Contractor's activity in the site. Providing that the Contractor need the space for temporary stock yard, his temporary office and any other space for the Contractor's activity outside of the site, the cost is deemed to include in the Accepted Contract Amount. Except where otherwise specified on the drawings, the Contractor shall limit the area of its construction activities to the area within the Site.

3.2 Surveys and Soil Investigations

The Contractor shall execute all surveys as required by the Specification Division II and as the Contractor considers necessary for proper implementation and completion of the Works. These surveys and soil investigations shall include those necessary for verifying the various data and information provided by the Employer or the Engineer. The Employer shall in no way guarantee the accuracy or sufficiency of the relevant data and information provided by him including those provided during the bidding period.

The Contractor shall prepare and submit a survey plan to the Engineer for review at least seven (7) days before commencement of the subject survey. The Contractor shall also prepare and submit a survey record/report to the Engineer for review at least seven (7) days after completion of the subject survey, except where an agreement otherwise is made with the Engineer beforehand.

Immediately after the Contractor’s finding of any errors in or discrepancies between the data and information provided by the Employer or the Engineer and the factual data obtained in the surveys, the Contractor shall inform the Engineer of such finding, for his verification and subsequent instructions.

3.3 Existing Utilities, Services and Structures

The Employer shall in no way guarantee the accuracy or sufficiency of the relevant data and information shown on the Drawings or otherwise provided by him including those provided during the bidding period. The Contractor shall be deemed to have allowed all costs necessary for the modification, use and removal/reinstatement of the existing utilities, services and structures in the Accepted Contract Amount. The Contractor shall provide

additional utility lines and services appropriate for the proper execution of the Works, and the costs shall be deemed included in the Accepted Contract Amount. Within twenty-eight (28) days of the commencement date, the Contractor shall undertake a detailed survey of the Site to determine the exact locations, routes, types and sizes of all existing utility lines, services and structures. From the survey, the Contractor shall draw up plans showing the exact information of all existing utility lines, services and structures as aforementioned and submit them to the Engineer for record. This record shall be promptly updated by the Contractor whenever any existing utility line or structure is found or a new utility line or structure is installed.

Unless otherwise consented by the owner and approved by the Engineer in advance, the Contractor shall not interfere in any manner with the existing utility lines and services other than those to be removed, replaced, diverted, rescheduled or renovated under the Contract. Whenever the interfering necessity arises, the Contractor shall discuss with its owner and submit a proposal to the owner for consent or otherwise. Any unnecessary interference caused shall be immediately removed without causing danger and trouble to any on-going operations relying upon the existing utility lines or services.

The Contractor shall survey and ascertain, as noted above, the locations, routes, etc of the existing utility lines, services and structures within the areas of his operation and, subject to consent by the owner and approval by the Engineer, shall make necessary arrangements with the parties concerned for the interference, removal, replacement, diversion, renovation and/or protection of all such items to be affected by the Contractor's operations. The Contractor shall pay all costs associated with the said interference, removal, replacement, diversion renovation and/or protection work and the costs, including the fees payable to the concerned parties, shall be deemed included in the Accepted Contract Amount.

If permitted by the party owning, or responsible for, the existing utility line, service or structure, the Contractor may interfere, remove, replace, divert, reschedule, renovate and/or protect it to the approval of the said party and the Engineer. Costs of all such operations shall be deemed included in the Accepted Contract Amount.

If any utility line, service or structure is found or uncovered, which was not recorded by the survey noted above, the Contractor shall be responsible for all costs, damages or hindrance, whether direct, indirect, incidental or consequential, arising from the discovery of such service or structure. To avoid undue damages, the Contractor shall carry out preliminary investigations, through trial excavation by hand or other suitable means, before commencing any mechanical excavation in the vicinity of known utility lines or structures.

3.4 Disposal Area Grading

All excavated soil including construction debris and solid wastes, shall be disposed of properly off the Site in strict accordance with the relevant applicable Laws and the relevant environmental protection requirements. A certificate or record of proper disposal as required under the relevant Laws shall be maintained by the Contractor and presented to the Engineer whenever so instructed by him.

3.5 Site Signboards

3.5.1 Requirement of the Site Signboards

The Contractor shall design, supply, erect and maintain until removal after receipt of the Taking-Over Certificate for the whole of the Works at each site illuminated site signboards, each 3m wide and 5m high and elevated above ground. The exact locations and

announcement of the Project and the announcement of the Zone-1 project with WWTP by the graphics and texts will be instructed.

The signboards shall be designed and constructed to the approval of the Engineer and maintained and kept in good condition until removal thereof after receipt of the Taking-Over Certificate.

The Contractor shall remove the signboards and associated footings and repair the ground surfaces flat, to the Engineer's approval.

The Contractor shall not and shall cause the Subcontractors not to install any other signboards or display any advertisements within or in the vicinity of the Project site, without first obtaining an express permission from the Engineer.

3.5.2 Payment of the Site Signboard

The price of site signboards will be paid for in the following manner

a. Eighty percent (80%) of the price will become payable to the Contractor upon completion of installation of these two signboards to the approval of the Engineer, and

b. The remaining 20% will become payable upon proper removal and disposal (or acceptance by the Engineer, if the signboards should remain installed) of the signboards.

The price shall be deemed to include the electricity bills, costs of the consumables and the maintenance and repair services, and no separate payment will be made for these items.

3.6 Cleaning of the Site and the Works upon Completion

Upon completion of the Works and before the Employer's issue of the Taking-Over Certificate for the whole of the Works, the Contractor shall remove from the Site all surplus and discarded materials, rubbish, stumps and other portions of unnecessary trees and all other debris. The Contractor shall cut or mow all grasses and shrubs within the Site to leave the Site in a neat and presentable condition. All debris removed from the Site shall be disposed of properly.

Inside of pipe shafts, pipelines, and similar spaces shall be cleaned and left free from debris, rubbish, plaster and mortar droppings, extraneous construction materials, dirt, dusts, projecting burrs and similar defects.

Care shall be taken by the Contractor's Personnel not to mark, soil, stain or otherwise deface finished surfaces. In the event that finished surfaces become defaced, the Contractor shall clean and restore/repair such surfaces to the Engineer's approval.

The Contractor shall comply with the applicable health, safety and environment-related Laws during the cleaning operations. Debris shall not be buried and volatile or other harmful or dangerous substances shall not be discharged into drainage systems or soil.

3.7 Removal/Disposal of structure and Obstruction

The Contractor shall remove any and all materials not suitable for use in the Work. Such removal shall be performed at the Contractor's own cost and expense and is considered subsidiary Work included in other items of Work performed.

The disposal of materials outside the project boundaries shall be the responsibility of the Contractor. He shall make his arrangements with the property owners of disposal sites outside the project boundaries as indicated on the Plans or Contract Documents.

The Contractor shall obtain a written permit from the property owner of the disposal site. He shall submit to the Engineer the said permit absolving the Employer from any and all

responsibility in connection with the disposal of materials on his property. No material shall be disposed without prior authority from the Engineer.

When materials are disposed as provided above and the site is visible from the roads, the Contractor shall make the disposal in a neat and presentable manner to the satisfaction of the Engineer.

3.8 Remove and Grub Large Trees, Plantation and Transportation of Trees

1) Requirement

The trees for removal and grubbing and the location of the trees for the plantation and transplantation shall be confirmed among the parties.

2) Payment

The payment of the work mentioned in this Clause is done based on the Bill of Quantities.

Section 4 - Documents to be Provided/Approved by the Engineer

4.1 Administrative Systems Documents

The Engineer will issue to the Contractor the administrative systems documents describing the standard procedures of the Engineer for all documentation for the Project, within twenty-eight (28) days of the Commencement Date. These procedures will cover documentation including document numbering, filing and control of documents pertaining to the following items:

a. Project general correspondence;

b. Approval of Contractor's Documents;

c. Payments;

d. Instructions;

e. Inspections/quality assurance; and

f. Claims and disputes.

After issuance to the Contractor, these procedures will be discussed, reviewed and agreed by and between the Contractor and the Engineer, and shall then be implemented by both parties.

4.2 Engineer's Review Comments/Approval on Contractor's Documents

The Contractor shall submit the Contractor's Documents specified in the Contract. Unless otherwise specified, the Contractor shall submit six (6) copies of each of the Contractor's Documents.

The Engineer will review the Contractor's Documents for the Engineer's approval and return the Contractor's Documents with approval, disapproval, approval with comments, etc. within the specified period.

The Engineer will convey his review results to the Contractor within the period agreed between the Engineer and the Contractor in advance. The Contractor shall allow sufficiently long periods for the Engineer's review of documents of large volume. The Engineer's review results will be as follows:

a. **Approved**: The Engineer approved the submitted documents without conditions or comments. The Contractor may proceed with the Works covered by these documents

based on these approved documents.

b. **Approved with Conditions**: The Engineer approved the submitted documents with certain conditions. The Contractor shall submit the revised version of these documents reflecting the Engineer's comments or conditions, for approval by the Engineer. This process shall be repeated until these documents reach the "Approved" status as above. The Contractor may proceed with the Works covered by these "Approved with Conditions" documents, at the Contractor's risk, provided that the Contractor uses adequately revised version of these documents reflecting the Engineer's comments or conditions, submit to the Engineer copies of the revised version without delay, prepares the shop drawings and other necessary documents to the satisfaction of the Engineer, and bears any additional costs arising from changes made to these documents afterwards as needed to reach the "Approved" status.

c. **Disapproved**: The Engineer reviewed but could not approve the submitted documents due to significant errors, omissions, discrepancies and/or non-compliance contained in these documents. The Contractor shall submit the revised version of these documents for approval by the Engineer. The Engineer will convey his review results to the Contractor within the period allowed for each type of the Contractor's Documents. This process shall be repeated until these documents are approved without conditions as above. The Contractor shall not proceed with the Works covered by these documents, until these documents reach at least the "Approved with Conditions" status as above.

d. **Not Reviewed**: The submitted documents were incomplete and the Engineer could not review as a whole, and the documents were returned to the Contractor without the Engineer's in-depth review. The Engineer will return the documents as early as practicable. The Contractor shall complete and resubmit the documents. The specified or agreed Engineer's review period begins on the day the resubmission is received by the Engineer.

The Contractor's Documents submitted to the Engineer for approval may be deemed reached the "Approved" status, when the Engineer's review period allowed for each of the submitted Contractor's Documents as specified or agreed with the Contractor have elapsed after the Engineer's receipt of the Documents and the Contractor did not receive any response from the Engineer within twenty-eight (28) days except the national holidays of the Republic of Indonesia. In such a case, the Contractor may proceed with the Works covered by these documents based on the "deemed approved" documents upon serving a written notice to the Engineer in this regard.

The Engineer's approval or the "deemed approval" as above shall not relieve the Contractor from any responsibility he has under the Contract, including responsibility for errors, omissions, discrepancies and non-compliance. For the avoidance of doubt, any change or additional work arising out of or becoming necessary from errors, omissions, discrepancies and non-compliance on the part of the Contractor in the Contractor's Documents shall not constitute a Variation.

The "Disapproved" Contractor's Documents may be used only for obtaining quotations or placing preliminary orders for the Goods, at the Contractor's risks and liabilities.

Section 5 – Contractor's Temporary Facilities

5.1 General

The Contractor shall be entirely responsible for the provision, erection, maintenance and removal on completion of execution of the Works of all required temporary facilities, as part

of the Temporary Works, for proper execution and completion of the Works. The costs, including without limitation the license fees payable to the relevant authorities and the utility bills, shall be deemed included in the Accepted Contract Amount.

All of the Contractor's temporary facilities on the Site or elsewhere within the Project site shall be designed, provided, erected, maintained and removed to the approval of the Engineer and in strict accordance with the applicable Laws. The Contractor shall obtain all necessary approvals and permits from the authorities of jurisdiction for provision, erection, operation, maintenance and removal of the Contractor's temporary facilities.

All of the Contractor's temporary facilities are to be removed on completion of execution of the Works and the ground surfaces reinstated to the satisfaction of the Engineer.

When deemed indispensable for health, safety, security and/or environmental protection, the Engineer will instruct the Contractor to modify the Contractor's temporary facilities regardless of his previous approval given, and the Contractor shall promptly comply with such instructions. These instructions shall not constitute Variations.

5.2 Location of Temporary Facilities Area

The precise locations of the Contractor's Temporary Works including the temporary facilities shall be proposed by the Contractor and approved by the Engineer.

The Contractor shall submit drawings showing the proposed locations and outlines of the proposed temporary facilities. Drawings and details of the Temporary Works for a particular part of the Permanent Works may be submitted as part of the shop or working drawings and/or the work method statements forming part of the Contractor's Documents. These location and outline drawings for the temporary facilities shall be submitted twenty-eight (28) days before commencing the construction of any temporary facility or twenty-eight (28) days after the Commencement Date, whichever is earlier. These drawings and outlines shall be updated whenever addition or removal of any facility is planned. Detailed drawings for any particular temporary facility, showing all necessary utilities and services, shall be submitted at least fourteen (14) days before the planned commencement date of construction thereof.

The areas for the Contractor's temporary facilities may also be used for temporary storage of excavated material suitable for reuse in embankment or fill for the Works, or for use by the Employer in future projects or on other works packages.

The Contractor shall make own arrangements for any additional areas required for proper execution of the Works, and the costs shall be deemed included in the Accepted Contract Amount.

5.3 Temporary Facilities

The Contractor shall provide all necessary temporary facilities including, but not limited to the following, operate and maintain all such facilities in good conditions throughout the duration of the Works, and remove all such facilities when they become no longer required for the execution of the Works:

a. office buildings;

b. storage buildings and warehouses;

c. medical facilities;

d. toilets/restrooms;

e. firefighting facilities;

f. roads;

g. ditches, culverts and pipes for irrigation and drainage;

h. fences; and

i. utility lines.

Costs for the provision, operation, maintenance and removal of the Contractor's temporary facilities shall be deemed included in the Accepted Contract Amount.

The Contractor shall keep on the Site all necessary surveying equipment and tools regularly calibrated.

The Contractor shall in all respects be fully responsible for ensuring necessary first-aid services to his employees in respect of injuries resulting from accidents occurred on the Works. The Contractor shall be responsible for all first-aid charges for his employees, and shall also arrange and pay for any medical services obtained from the respective hospitals for injured personnel and for arrangement of adequate ambulance in case of accident or injury.

The first-aid services shall also be made available free of charge to all of the Employer's and Engineer's personnel who may be designated by the Engineer.

The Contractor shall maintain all of the Contractor's temporary facilities in a condition fit for the purpose and in a clean, safe and sanitary condition.

Except those provided by the Employer, the Contractor shall make his own arrangements for the provision, operation, maintenance and removal, in strict accordance with the applicable Laws, of all temporary utilities and services including, but not limited to the following:

(a) electrical power supply and distribution;

(b) telecommunication system;

(c) water supply, storage, treatment and distribution;

(d) storm-water collection, storage, treatment and disposal;

(e) sewer collection, storage, treatment and disposal; and

(f) solid waste collection, storage, treatment and disposal.

The temporary utilities available on the Site for the Contractor's use for the construction, test, operation and/or maintenance of the Works and the Contractor's facilities on the Site shall be as shown on the Drawings. The Contractor shall be responsible to locate, modify, extend, use, terminate and reinstate the original conditions of the utilities as required or approved.

The Employer or any of the relevant authorities and utility and service suppliers cannot guarantee the uninterrupted supply of sufficient utilities or services throughout the period of execution of the Works. The Contractor shall, therefore, make any provisions that the Contractor considers necessary to cope with the interruption, insufficiency or other difficulties of the temporary utilities and services provided by others.

Costs for the Contractor's use of the utilities shall be deemed included in the Accepted Contract Amount.

5.4 Contractor's Equipment

The Contractor shall ensure that all of the Contractor's Equipment on or in the vicinity of the Site, including apparatus, machinery, vehicles and other similar things to be operated by him or his Subcontractors for the execution and testing of the Works, are maintained and operated in a good, safe condition.

All lifting and hoisting equipment shall be regularly certified in accordance with the applicable Laws, and the safe working load limits shall not be exceeded.

The Contractor shall maintain an equipment repair shop within or in the vicinity of the Site so that out-of-service periods of the Contractor's Equipment can be minimized. Temporary fuel and lubricant storages shall be properly constructed, secured, fire and spill-guarded, and well ventilated to comply with the relevant applicable Laws.

5.5 Payments for Contractor's Temporary Facilities

The Contractor's temporary facilities will be paid for in the following manner:

a. Eighty percent (80%) of the price stated in the Contract of each item of the Contractor's temporary facilities or part there of will become due to the Contractor upon the Engineer's certification of substantial completion of the subject facilities; and

b. The remaining twenty percent (20%) will become due to the Contractor upon the Engineer's certification of removal or transfer of the subject facility to the satisfaction of the Engineer.

Costs of other temporary facilities not listed in this clause shall be deemed included in one of the listed facilities and will not be paid separately.

The operation and maintenance price shall be deemed to cover all costs necessary for proper operation and maintenance of the temporary Contractor's facilities, including costs of utilities and consumables, in accordance with this Specification and the applicable Laws. The costs of the site office building shall be deemed to include, without limitation, all costs of the personnel working in the office. The costs of the laboratories shall be deemed to include, without limitation, all cost of the personnel and laboratory equipment.

Section 6 – Mobilization and Demobilization

6.1 General

The Contractor shall mobilize to the Site the Contractor's Equipment and the Contractor's Personnel as appropriate for the execution and completion of the Works in strict accordance with the approved Working Programme

The Contractor shall demobilize from the site the Contractor's Equipment and the Contractor's Personnel as appropriate when they are no longer required to be on the Site.

6.2 Engineer's Consents

The Contractor shall submit to the Engineer for consent an application for mobilization of any of the Contractor's Equipment, including those for use by the Subcontractors, at least seven (7) days before the mobilization thereof to the Site. Provided that the proposed mobilization is in general accordance with the Working Programme and the method statements approved by the Engineer, that the Contractor shall be solely responsible for the consequence of the mobilization and that the relevant insurance is in place as evidenced by the documents included in the application, the Engineer shall not unreasonably withhold the consent.

The Contractor's Equipment shall be mobilized to the Site complete with all necessary spare parts, consumables and the like indispensable for proper operation and maintenance thereof. Provision of the maintenance shop with qualified maintenance crew on or in the vicinity of the Site will be required as a prerequisite condition for the issue of the Engineer's consent.

The Contractor shall obtain a written consent from the Engineer before removing any of the Contractor's Equipment from the Project site or any managerial person among the Employer's Personnel mobilized exclusively for the Contract. Provided that the proposed demobilization is in general accordance with the Working Programme and that the Contractor shall be solely responsible for the consequence of the demobilization, the Engineer shall not unreasonably withhold the consent.

Although they are deemed intended for exclusive use for the Works, the Contractor may divert any of the Contractor's Equipment to other uses within the Project site, provided that the Contractor's written undertaking to return the same to the Works whenever needed is submitted to the Engineer and the Engineer's written consent to the diversion is granted.

6.3 Records

In addition to the monthly reports, the Contractor shall submit to the Engineer, on a daily basis, details of the mobilization and demobilization of any of the Contractor's Equipment or any managerial person among the Employer's Personnel. This shall be part of the Daily Progress Report.

Without undue delay after demobilization from the Project site, the Contractor shall submit to the Engineer copies of the certified evidences of lawful re-export from the Country of the respective Contractor's Equipment imported on a temporary basis exclusively for the Contract.

Section 7 - Contractor's Design

7.1 Scope and Criteria of Contractor's Design

The Contractor shall design the Works to the extent specified below and elsewhere in the Contract, in accordance with the Contract and with the Engineer's instructions.

a. Preparatory Works

b. Shaft Construction

c. Pipe Installation

d. Construction of Manhole

The Contractor shall be solely responsible for the adequacy of the design prepared by him.

The performance requirements and other design criteria shall be as set forth in the relevant Divisions of the Specification and/or shown on the relevant Drawings, in addition to those common criteria specified hereunder.

As part of the Contractor's design services, the Contractor shall review the Employer's designs of the remaining part of the Works, and advise the Engineer in writing of any modifications recommendable to make the part of the Works better fit to the systems to be supplied by the Contractor.

7.2 Contractor's Design Documents

Before commencing procurement, fabrication or construction thereof, the Contractor shall prepare and submit to the Engineer for approval the Contractor's proposed design of the respective part of the Works to be designed by the Contractor.

The design documents to be submitted shall include the following as a minimum:

a. design briefing reports explaining the proposed system and the design criteria applied and/or the Employer's requirements considered;

b. detailed design drawings showing layout and dimensions of the equipment, etc.;

c. specification including the performance specification, for comparison with the specification given in the Contract;

d. list of special tools and the like;

e. catalogues, brochures, samples, models, and other relevant documents for the Engineer's consideration; and

f. manufacturers' printed instructions for the respective proprietary materials, products, equipment, etc. included in the proposed design.

All drawings shall be in CAD format (AutoCAD) compatible with the Engineer's CAD format (AutoCAD) unless otherwise approved by the Engineer. All of the Contractor's design documents shall be written in English with translation in Indonesian. Where practical, translations in English may be shown below the Indonesian original texts. Where such arrangement is impractical or inadequate and when the Engineer consents, the Indonesian version and the English version of such documents shall be presented in separate volumes.

The Engineer shall review the design documents submitted by the Contractor and a response issued to the Contractor.

The Contractor's design documents shall be prepared by licensed designers and engineers and quality assurance-checked by appropriate licensed engineers, ideally belonging to the quality assurance organization of the Contractor, for the functionality and constructability of the proposed design. The checker shall place his signature on the documents which he has checked and approved for submission to the Engineer. The Engineer may require the Contractor to submit CVs of the respective key personnel involved in the Contractor's design.

The Contractor's design schedules shall be shown in the programmes, both the Working Programme and the Detailed Programmes. The design documents shall be submitted well in advance of the procurement, fabrication or construction so that no delay will occur even when the resubmission is required.

Upon request from the Engineer, the Contractor shall cause the designer and/or the checker meets with the Engineer during the Engineer's review period, for clarification of the discrepancies and/or ambiguities found in the deliverables. Any delay or failure on the part of the Contractor in this regard shall cause the automatic and unconditional prolongation of the response period allowed for the Engineer under the Contract, without imposing any penalty on the part of the Employer and the Engineer.

Each submission shall include five (5) hard, printed copies and one (1) electronic soft copy of each document.

7.3 Common Design Criteria

In the Contractor's design, the Works as a whole shall be designed for the continuous operation on the basis of 24 hours a day and 7 days a week, except where otherwise expressly stated elsewhere in the Contract. Adequate back-up systems and equipment shall be proposed in the Contractor's design, to comply with this operational requirement.

Section 8 – Contractor's Management of the Works

8.1 General

The Contractor shall provide the management and staff, both on the Site and at the head office, necessary for the execution, completion, commissioning, operation and maintenance of the Works and the remedying of any defects therein in strict compliance with the Contract.

The Contractor shall be entirely responsible for the adequacy of supervision and management of the Works throughout the duration of the Works and shall discharge his duties in this respect in a diligent and professional manner.

8.2 Quality Assurance/Control

The Contractor shall institute a quality assurance system to demonstrate compliance with the requirements of the Contract. The system shall be in accordance with the details stated below and the Engineer shall be entitled to audit any aspect of the system.

Details of all quality assurance plans and procedures, and compliance documents shall be submitted to the Engineer for information before each design and execution stage is commenced. When any document of a technical nature is issued to the Engineer, evidence of the prior approval by the Contractor himself shall be apparent on the document itself.

Compliance with the quality assurance system shall not relieve the Contractor of any of his duties, obligations or responsibilities under the contract.

The Contractor shall cause the Subcontractors to submit, for the Contractor's review and comments, the Subcontractors' similar quality assurance documents, so that the necessary documents are in place before each design or execution/construction stage of either the Temporary Works or the Permanent Works is commenced by the relevant Subcontractors.

In order to ensure full compliance with the contractual requirements and obligations for the Contractor's quality assurance of the Works, and to demonstrate that the Contractor's quality assurance is implemented as required to attain the specified level of quality of the Works throughout, the Contractor shall first prepare the suitable quality assurance plans and procedures, then perform the Works in strict accordance with these documents while entering and maintaining the record documents, and whenever necessary take corrective actions as appropriate to correct the deficiencies and failures found in the quality assurance system and/or documents. This process shall be in general compliance with the ISO 9001 quality management system, unless otherwise approved by the Engineer.

The quality assurance plans and procedures shall set out the Contractor's specific, proposed quality assurance plans and procedures, including practices and sequence of activities to be followed and resources to be input to meet the quality assurance requirements of the Contract and shall include, but not be limited to:

1) Contractor's quality statement;
2) Contractor's organization structures including a quality assurance department free from influence of other departments;
3) Contractor's quality assurance procedures;
4) CV of principal staff members of the quality assurance department;
5) Design quality assurance procedures for the preparation of the Contractor's Documents as defined in the Conditions of Contract;
6) Quality assurance procedures for selecting and appointing Subcontractors including

suppliers and independent testing laboratories;

7) Quality assurance procedures for obtaining, reviewing and approving Subcontractors' quality assurance procedures and for quality auditing of Subcontractors;

8) Quality assurance procedures for procurement of Materials and Contractor's Equipment;

9) Quality assurance procedures for interface coordination of the Works;

10) Quality assurance procedures for construction, inspection and testing of the Works;

11) Quality assurance procedure for commissioning, operation and maintenance until receipt of the Taking-Over Certificate for the Works where applicable;

12) Document control procedure;

13) Environmental management procedure;

14) Site operational control procedure;

15) Internal quality audit procedure;

16) Quality assurance procedures for as-built information records and operation and maintenance manuals; and

17) Method statements for control of changes to the quality assurance plans and procedures.

18) The proposed organization structure charts forming part of item 2) above shall illustrate the sub-divisions along with their main tasks and the lines of command and reporting including:

19) Interface between the Contractor, the Engineer and the Employer;

20) Interface between the Contractor's departments including the quality assurance department;

21) Interface between the Contractor and Subcontractors, suppliers and testing laboratories;

22) Coordination between the Contractor and the authorities of jurisdiction; and

23) Arrangements for the Contractor's internal quality management including quality auditing.

It shall be the principle that the Contractor's submittals including the progress reports, programmes, design documents and other Contractor's Documents shall be finally checked by the quality assurance department of the Contractor before being issued. The Contractor's quality assurance organization and procedures shall be structured to meet this requirement.

The Contractor shall assign a suitably experienced and qualified Quality Engineer to the Contract. The Quality Engineer, or his alternate approved by the Engineer, shall be on the Site while the Works is in progress.

The Quality Engineer shall in particular, but not limited to, carry out internal and external audits of the Contractor's and the Subcontractors' organizations to audit the status of their application implementation of the quality assurance activities based on the approved quality assurance plans and procedures. The Quality Engineer shall have the authority to override the Contractor's Representative on all aspects relating to the quality assurance or control, including the authority to stop the work not in compliance with the Contract and remove any non-complying work. The Quality Engineer shall not be replaced without the Engineer's prior written approval.

The audits shall be conducted in accordance with a rolling programme to be submitted to the Engineer as part of the quality assurance plans and procedures. The progress of the audits

and proposed revisions to the rolling programme, if any, shall be included in the Contractor's monthly progress report.

The Engineer will audit the Contractor's implementation of the quality assurance in accordance with the proposed quality assurance documents, as and when he reasonably thinks necessary to ensure quality of the Works. The Contractor shall cooperate, and cause the Subcontractors to cooperate, with the Engineer in the audit. The Engineer and his staff shall be allowed to observe and/or take copies of the relevant quality assurance documents prepared and/or entered by the Contractor or the Subcontractors, as and when so instructed by the Engineer.

The Contractor shall keep and cause the Subcontractors to keep in house the quality assurance records for a minimum period of two (2) years after the date of the Taking-Over Certificate for the whole of the Works, and shall allow and cause the Subcontractors to allow the Employer to observe and/or take copies of these records as and when reasonably instructed by the Employer.

Within twenty-eight (28) days after Commencement of the Works, the Contractor shall submit a statement to the Engineer describing the organization and resources, which the Contractor proposes and undertakes to provide, to control the quality of the Works, including the work of all manufacturers, subcontractors and suppliers. The statement must include the number and type of staff responsible for quality control, with details of their qualifications and duties.

Compliance with the quality assurance system shall not relieve the Contractor from any of the requirements of the Specifications with regard to testing of all materials proposed for the works and the Engineer's inspection of each stage of the completed works before covering up and shall not relieve the Contractor of any of his duties, obligations or responsibilities under the Contract.

8.3 Control of Time

8.3.1 Time for Completion to be Programmed and Controlled

The Contractor shall be deemed fully aware that time is of the essence of this Contract Agreement and the Works shall be programmed and scheduled in such a manner that the Works or the Sections will be completed within the designated time period.

The Contractor shall complete the whole of the Works, and each Section (if any), within the Time for Completion for the Works or the Section (as the case may be) stated elsewhere in the Contract.

To ensure this, the Contractor shall prepare and submit to the Engineer for approval various programmes and control the time based on the approved programmes. Any approval by the Engineer shall not relieve the Contractor from any responsibility he has under the Contract.

8.3.2 Programme Designations

For the purpose of this Specification, the time programmes are designated as follows:

a. The "Contract Programme" shall be the "schedule" submitted by the Contractor as part of the Bid, incorporating any modifications thereto agreed between the Employer and the Contractor before execution of the Contract Agreement, and included in the Contract. The Contract Programme shall be the baseline programme for assessing any extension of the Time for Completion and any delay damages.

b. The "Working Programme" is the detailed original or revised time programme to be submitted by the Contractor to the Engineer. This Programme shall cover the whole of the Time for Completion as indicated on the Contract Programme. This Programme is a

revolving programme to be updated as and when needed.

c. The "Three (3) Months Detailed Programme" and the "Three (3) Weeks Detailed Programme" shall be the further detailed version of the Working Programme above, covering the items, Sections or parts of the Works to be designed or executed within the next three (3) months and three (3) weeks, respectively. The activities executed in the last month and the last week should be shown on the Three Months Detailed Programme and the Three Weeks Detailed Programme, respectively, for ease of assessment of the probable rates of progress of the continuing activities.

8.3.3 Programming Requirements

The following programming requirement shall be complied with:

a. The Working Programme and the Detailed Programmes shall be developed on recognized computer software, to present Gantt/bar charts with links to show essential logic and a critical path or paths.

b. The Working Programme shall be same in overall logic and timing as the Contract Programme but shall be in more detail showing more subdivided activities/works and shall clearly indicate the expected date of Taking-Over Certificate for the respective Section and whole of the Works.

c. The Working Programme shall contain at least the following information on the timing, duration and sequencing of:

(i) activities for which the Contractor and the Subcontractors are responsible, including but not limited to:

- preparation of design, construction, shop and/or fabrication drawings and approval/comment period allowed for the Engineer, the Employer and/or the authorities of jurisdiction;
- appointment of the Subcontractors;
- shop fabrication;
- shop testing/inspection with or without the presence of the Engineer;
- delivery to the Site including customs clearance;
- construction and/or installation;
- tests on completion including preparation of operation and maintenance manuals;
- commissioning and training, if any; and
- completion activities including "as-built" drawings;

(ii) activities for which the Employer and/or the Engineer is responsible to the Contractor, e.g. giving right of access to the Site, issue of Employer's documents, delivery of the Employer's Equipment.

d. The Working Programme shall be updated from time to time by incorporating any changes necessitated by other Programmes produced by the Contractor or produced by the Subcontractors and approved by the Contractor. The Working Programme, and the relevant Detailed Programmes, shall be promptly updated by incorporating the extension of Time for Completion determined by the Engineer.

e. The Detailed Programmes shall at all times be fully consistent with the latest approved Working Programme as of the day of submission of the respective Detailed Programme.

f. The Detailed Programmes shall in general be broken down appropriately to the pay items by facilities, areas, locations, floors, sections, structural or finishing elements, etc., as may be shown in the Bill of Quantities.

g. The Working Programme and the Detailed Programmes shall contain at least the following information on the respective activities:

(i) activity code/number and title/brief description;

(ii) quantities of the activities/works and the resources to be input for each of the activities/works including the mobilization and demobilization schedule of the Contractor's Equipment;

(iii) earliest and latest start and finish dates with available float;

(iv) actual start and finish dates;

(v) party responsible for each activity shown, e.g. Contractor, Engineer, interfacing contractor; and

(vi) information needed to work out the planned and actual progress S-curves.

The Three Months Detailed Programme shall indicate the actual progress in the previous month and the planned progress in the next 3 months, whereas the Three Weeks Detailed Programme shall indicate the actual progress in the previous week and the planned progress in the next 3 weeks, to allow the Engineer evaluate the Programmes based on the actual progress accomplished in the previous month or week.

h. For the timely preparation and updating of the Programmes, the Contractor shall have on the Site at least a full-time quantity surveyor manager.

i. "The Contractor shall submit a detailed time programme to the Engineer for his consent within 28 days after receiving the instruction.

Programme requirements and Time for Completion of the Works are indicated in the Contract. The Contractor shall be deemed to have included any other and further constraints for which the Contractor is responsible.

Unless otherwise instructed by the Engineer, the programme shall be in the form of a Critical Path Method (CPM) Network and include:

"The programme shall be submitted in the form of a Time Bar-chart showing a Critical Path and S-curve (cumulative progress in percentage). The Time Bar-chart Schedule shall list all main activities and applicable sub-activities.

The CPM Network shall be prepared in accordance with commonly accepted practices and shall show graphically the chain of activities/sub-activities and their sequential relationship with each other from the Commencement of the Works to the completion of the Contract. It shall include clearly all activities and their durations along with earliest and latest event times, free and total floats, dates of submission of the Contractor's drawings, each date of shop inspection by the Engineer for the section or part of the Works; and shall meet the provisions of the Contract in all respects. It shall be noted that the Contractor does not have an exclusive right to use free and total floats.

In preparing the CPM Network and the Time Bar-chart Schedule showing a Critical Path and S-curve, the Contractor shall make due allowances for reasonably foreseeable delays, which may be caused by floods, inclement weather, all types of holiday periods, local working conditions, problems relating to maintenance of equipment, problems relating to obtaining of materials/supplies, and similar items. Under no circumstances shall the CPM Network or the Time Bar-chart Schedule show a completion date beyond the "Time for Completion".

Upon consent by the Engineer to the Contractor's programme, it shall be referred to as the Contractual Construction Programme, and become an integral part of the Contract. The Contractual Construction Programme shall supersede all other programmes and

shall be deemed to be the programme on which the Contractor has based his Accepted Contract Amount and in accordance with which he will execute the Works.

The Contractor shall also submit to the Engineer for his consent, at the request of the Engineer, a revised programme. The revised programme shall be prepared in the same form as is used for the Contractual Construction Programme and shall be submitted within ten (10) days of the request.

The Employer shall have the right to withhold the payment at any time if the Contractor fails to submit the Contractual Construction Programme or revised Contractual Construction Programmes due to his failure, negligence or omission.

8.3.4 Submission of Programmes

The Contractor shall submit to the Engineer four (4) hard copies and one (1) electronic copy, for viewing and printing only, of each of the Programmes prepared for submission to the Engineer.

The Contractor shall modify and submit the Contract Programme only when specifically instructed by the Engineer.

The Working Programme shall be submitted whenever updated for whatsoever reasons.

The latest, updated versions of the Three Months Detailed Programme shall be submitted every month, or whenever the Three Weeks Detailed Programme is modified, or whenever the updated Working Programme is submitted.

The latest, updated version of the Three Weeks Detailed Programme shall be submitted to the weekly meetings with the Engineer every week and whenever the updated Three Months Detailed Programme is submitted.

The Contractor shall keep on the Site or elsewhere designated by the Engineer a hard copy and an electronic copy of the Programmes submitted to the Engineer until settlement of all disputes under the Contract.

Immediately following the issue of the Taking-Over Certificate for the Works, the Contractor shall submit to the Engineer for approval three (3) hard copies of a cleaned up version of the Working Programme showing the actual sequence and progress of the Works. Upon approval by the Engineer, the Contractor shall submit the Working Programme, in the number of copies first above specified, as the as-built Working Programme.

8.3.5 Progress Control and Programme Update

The Contractor shall constantly monitor the progress of the Works, always using the Working Programme as a basis (or the Contract Programme in the absence of the Working Programme).

The Contractor shall promptly revise and update the Working Programme and the Detailed Programmes when:

a. it becomes apparent that the Works or portion(s) thereof are delaying or advancing than planned in the latest version of the Programme;

b. it is found that the logic and/or sequence planned in the latest version of the Programme of the activities need be modified;

c. it is found that the information contained in the Programme, such as quantities of the activities, are changed for whatsoever reasons;

d. it is found that the method or procedure including the quality assurance procedure needs be changed for whatsoever reasons and the change affects the progress of the Works or

portion(s) thereof;, or

e. the Engineer demands the update for explainable reasons such as change of the date of interface with other contractors' works.

Progress monitoring above shall include, but not be limited to, recording of the quantities of activities completed, analysis of actual weekly or daily work output in the activities and comparison of the actual and the planned outputs on at least a weekly basis. Reports on the progress shall be by pro-forma or other suitable format to be agreed with the Engineer.

8.4 Meetings and Reports

8.4.1 General

A Pre-Construction Conference shall be held for the purpose of establishing guidelines and procedures for the smooth execution of the Contract.

As soon as the Contractor has received the instruction to commence the Work, the Engineer shall set a pre-construction conference with the Contractor and his staff together with the Employer's representative(s). The Conference agenda shall include (but not limited to) the following:

1) Project Organizational set-ups with the definition of the lines of Authority.
   (i) Contractor's Table of Organization
   (ii) Engineer's Table of Organization
   (iii) Employers Table of Organization
2) Agreed Construction Schedule of the Contractor
3) Sources of Materials
4) Testing of Materials
5) Accomplishments, Estimates and Cut-off dates
6) Reporting and Monitoring
7) Billing Procedures
8) Sub-Contractors to be proposed for approval
9) Other matters/problems of specific nature to the project that could affect the progress of construction

8.4.2 Meetings

The Engineer shall hold such regular site meetings with the Contractor as necessary for the proper management and coordination of the Works, and the Contractor's Representative and other Contractor's Personnel inclusive of the Subcontractors' personnel either designated by the Engineer or the Contractor's Representative considers necessary shall attend such meetings.

Within four (4) weeks of the date of the Contractor's receipt of the Letter of Acceptance, the Engineer and the Contractor's Representative shall agree upon a programme for weekly and monthly meetings covering the first three (3) months of the Time for Completion. The Contractor's Representative shall make sure that the Contractor's Personnel designated to attend the meetings make themselves available for the meetings. The Contractor shall prepare the agenda of the meeting and the relevant documents to be submitted to the meeting, including at least the minutes of the previous meeting.

Thereafter, the programme shall be updated monthly in the monthly progress meetings.

The Engineer may call ad-hoc meetings as and when the need arises, through prior consultation with the Contractor's Representative where possible, and the Contractor's Representative and other Contractor's Personnel designated by the Engineer and/or the Contractor's Representative shall attend such meetings. The Engineer shall prepare a proposed agenda of the meeting, for prior consultation with the Contractor's Representative where possible.

The Contractor's Representative may request the Engineer to meet him and other Contractor's Personnel whenever necessary to discuss the issues pertaining to the Works and the Contract. The Engineer shall comply with the request where physically possible. The Contractor shall prepare a proposed agenda for the meeting and submit it to the Engineer when making request for the meeting.

The Contractor in principle shall be responsible for the preparation of the draft minutes of meetings, circulating it to the parties who attended the meeting for review and comments, and finalizing the minutes of the meeting before the next relevant meeting. The Contractor shall also be responsible for the minutes of ad-hoc meetings in a similar manner, unless otherwise agreed with the Engineer. Six (6) copies each shall be submitted by the Contractor, unless otherwise instructed by the Engineer.

For regular scheduled meetings, the Engineer and the Contractor shall agree upon the agenda including at least the review of the actions taken and improvements accomplished after the previous meeting. The Contractor shall prepare all necessary reports and data for these meetings in a manner and format to be agreed with the Engineer. These include but are not limited to the following items that will be reviewed at these meetings:

a. progress planned and progress achieved, along with the Contractor giving reasons for any delay and proposing actions to be or being taken to reduce or eliminate the delays;

b. actual returns of Contractor's Personnel and Contractor's Equipment assigned, against the planned requirements, along with the Contractor giving reasons for any differences and proposing actions to be or being taken to improve the situation;

c. any difficulties being encountered in the execution of the Works, along with the Contractor's proposed actions or solutions and the Engineer's actions needed;

d. any outstanding information/actions required of the Employer, the Engineer and/or the authorities of jurisdiction; and

e. any outstanding information/actions required of the Contractor.

To make the meetings as short in time as possible, the discussion of progress at these regular meetings will be at a summary level, with detailed discussions for exceptional cases only. Detailed progress reports, and other data where possible, to be discussed in the meeting shall therefore be submitted to the Engineer at least 24 hours in advance of the meeting.

8.4.3 Progress Reports

The Contractor shall prepare and submit to the Engineer the daily, weekly and monthly progress reports in both the ruling language of the Contract and the national language of the Country, i.e. the original in English and the translation in Indonesian, in such format as the Engineer may require or approve, covering the following information:

1) Daily Progress Report for 7 days a week, in three (3) hard copies

   (i) return of the Contractor's Personnel;

   (ii) return of the Contractor's Equipment;

(iii) quantity of the progress accomplished in the day;

~~(iv) quantity of the work undertaken on a daywork basis executed in the day;~~

(iv) weather conditions;

(v) inspections, tests, monitoring and the like conducted;

(vi) Contractor's Equipment, Materials and Plant delivered to the Site;

(vii) any issues/problems the Engineer and/or the Employer should be aware of; and

(viii) any other matters of importance under the Contract including environmental matters.

2) Weekly Progress Report, in three (3) hard copies

(i) weekly summary of return of the Contractor's Personnel;

(ii) weekly summary of return of the Contractor's Equipment;

(iii) weekly summary of the progress planned and progress achieved;

~~(iv) weekly summary of statements of the Daywork;~~

(v) weekly summary of adverse effects of weather;

(vi) weekly summary of Contractor's Equipment, Materials and Plant on the Site,

(vii) proposed progress planned in the next 3 weeks (in the form of a Three Weeks Detailed Programme);

(viii) any issues/problems the Engineer and/or the Employer should be aware of;

(ix) any approvals/actions required of the Engineer or the Employer in the next week; and

(x) any other matters of importance under the Contract including environmental matters.

3) Monthly Progress Report, in six (6) hard copies and one electronic copy and including the following additional information as a minimum:

(i) monthly summary of environmental matters; and

(ii) updated cash flow forecast (to be included in the Monthly Progress Report on a quarterly basis).

(iii) photographs showing the monthly progress and/or quality of the Works

Each of the Monthly Progress Reports shall contain an executive summary describing the actual progress achieved to the reporting date, the planned achievement in the next month, and the forecast of the Contract Price at the time of completion, along with the updated versions of the Working Programme and the Three Months Detailed Programme.

8.5 Security

The Contractor shall be wholly responsible for security on the Site and any other areas being used by him or the Subcontractors for the purposes of the Contract. The Contractor shall implement and cause the Subcontractors to implement proper security management procedures in accordance with the approved security management plan.

The Contractor shall assign on the Supervisor and his alternate(s), who shall be primarily responsible for the Contractor's security services and fully cooperate with the Employer's security organization throughout the Time for Completion.

Within twenty-eight (28) days of receipt of the Letter of Acceptance, but in no case later than the Commencement Date, the Contractor shall prepare and submit to the Engineer for approval a security management plan fully complying with not only the relevant applicable Laws but also the regulations of the Employer which may be imposed from time to time on the Project. The plan shall include detailed procedures for daily operation of the plan and submitted at least one week before commencing the Works on the Site or any other area being used by the Contractor. The Engineer's approval shall not relieve the Contractor of his responsibility under the Contract and the Laws.

The security management plan shall contain at least the following:

a. Security policy statement and objectives;

b. Contractor's security organization;

c. Role and power of each member of the security organization;

d. Procedure for enforcement of security regulations;

e. Daily, weekly and monthly security meeting procedures;

f. Sample forms for security reports;

g. Personnel security control procedures;

h. Goods security control procedures;

i. On-site security patrol procedures;

j. Liaison and coordination procedure with local fire/police and other authorities;

k. Liaison and coordination procedure with Employer and relevant other authorities;

l. Liaison, coordination and joint security inspection procedure with other contractors;

m. Coordination with health and safety plan; and

n. Compliance with the Employer's security programme.

Where necessary, the Contractor shall install, modify, maintain and remove the temporary security fences, gates, posts, security lightings and other facilities required for proper security control, in addition to those to be constructed as part of the Works. The Contractor shall operate these facilities to properly control ingress to and egress from the areas under his control throughout the Time for Completion. This control shall apply to every person including the Employer's Personnel.

The Contractor shall be entirely and solely responsible for the control of visitors to the Site and shall take such precautions and measures as are necessary for their security and safety.

The Contractor's Personnel and the Goods entering or leaving the Project site may be subject to the security inspection and checks by the Employer's security service personnel. The Contractor shall establish and operate a suitable system for security identity card for the Contractor's Personnel and the Goods under the Contractor's custody. The Employer reserves the right to reject the Project site entry of any person or Goods not complying with the Employer's security requirements.

8.6 Health and Safety

The Contractor shall be wholly and solely responsible for health and safety on the Site and any other areas being used by him for the purposes of the Contract. The Contractor shall ensure that all appropriate health and safety measures are implemented throughout the execution of the Works. Particular attention shall be paid to the HIV-AIDS Prevention requirements. Costs for all necessary measures including, without limitation, sanitary sewer,

garbage disposal, mosquito and epidemics prevention measures, HIV-AIDS awareness and alleviation programmes and the like necessary for the health of personnel on the Site, and safety netting, protective covering, warning signboards and the like necessary for the safety of the personnel on the Site and/or the protection of the Works, shall be deemed included in the Accepted Contract Amount.

Where labor works are performed at a height greater than 2m above the ground, the Contractor shall provide adequate scaffolds. Scaffolds shall:

a. be erected securely using suitable materials (resistant to corrosion and distortion) and construction methods best suited to the height, location, ground conditions, platform size and the working period;

b. be provided with adequate access ladders, handrails and/or toe boards; and

c. be strong, stable, durable and safe in all respects, as evidenced by the structural calculations to be prepared by the Contractor.

Where it is not possible to erect adequate scaffold, a protective safety net shall be installed and labors shall be secured with safety ropes and harnesses. Where construction works are performed at an excavation depth greater than 2 m below the adjoining ground, the Contractor shall provide adequate earth-retaining facilities for the excavation. The earth-retaining facilities shall:

a. be strong and stable to prevent the walls from sliding, as evidenced by the stability analysis to be prepared by the Contractor, by the use of earth retaining method and materials best suited to the depth, location, soil conditions and the working period;

b. be provided with adequate access ladders and handrails; and

c. be strong, stable, durable and safe in all respects, as evidenced by the structural calculations to be prepared by the Contractor.

All excavations shall be marked with fencing or high-definition tapes, and warning signs placed at regular intervals and at strategic locations. Slopes of the excavation shall be stable until completion of the backfill, as evidenced by the slope stability analysis to be prepared by the Contractor.

The Contractor shall provide, operate and maintain the first aid facilities as needed to fully comply with the health and safety requirements. Maintenance of the first aid facilities shall include supply of appropriate disinfectants, medicines, bandages, equipment, transportation and nurses as may be required, to treat types of injury and sickness that would usually be expected on the construction site of similar projects. The Contractor shall display clearly at the first aid stations the location and directions to the nearest hospital or medical center where first-aided patients can be sent.

Within twenty-eight (28) days of receipt of the Letter of Acceptance, but in no case later than the Commencement Date, the Contractor shall prepare and submit to the Engineer for approval a Health and Safety Management Plan fully complying with not only the relevant applicable Laws but also the regulations of the Employer which may be imposed from time to time on the Project.

The Health and Safety Management Plan shall contain adequate control measures and procedures, in accordance with the relevant applicable Laws and the Employer-imposed regulations as well as internationally accepted good practice, for the prevention of contamination, food poisoning, epidemics, diseases, accidents, fires and public nuisance. The health and safety management plan shall be implemented by the Contractor and the Subcontractors properly and diligently throughout the execution of the Works.

The Contractor's Health and Safety Management Plan shall address at least the following:

1) Contractor's health and safety management policy;
2) Contractor's health and safety management organization;
3) Roles and power of key members of the health and safety management organization;
4) Applicable Laws;
5) Enforcement of health and safety regulations including system of warning;
6) Daily, weekly, monthly meetings;
7) Health and safety management reports including accident reports;
8) Corrective measures to improve unhealthy/unsafe conditions;
9) Sanitation including sanitary sewer;
10) Garbage collection and disposal;
11) Controlling/exterminating of rats, insects and pests;
12) Accident prevention signs and notices;
13) Health and safety audits and inspection;
14) Permits for work in dangerous or restricted work areas;
15) Safety gears and protective clothing, including hard helmets, footwear, goggles, etc;
16) Emergency procedures;
17) First aid medical facilities;
18) Traffic control including signalling and barricading;
19) Visitors/guests permitting and control;
20) Fire prevention and fire-fighting;
21) Electricity leakage, and electric shock;
22) Oxygen/acetylene/fuel gases;
23) Deep excavation and trench shoring;
24) Excavation in the vicinity of underground utilities;
25) Operations in confined spaces;
26) Operations in or under water;
27) Explosives and blasting;
28) Guard-railing, hand-railing, barricading and opening covering;
29) Scaffolding and staging and fall protection;
30) Elevated work;
31) Craning and hoisting;
32) Handling and storing of chemical agents;
33) Training and education of the Contractor's Personnel;
34) Temporary fencing for prevention of trespassing; and
35) Temporary lighting.

The Contractor shall appoint a Health and Safety Manager and his alternate(s), who shall be primarily responsible for fully implementing the health and safety management plan. The health and safety manager, or the appointed alternate when the manager is off the Site, shall be the responsible and liable person under the applicable Laws, and shall stay on the Site while the Contractor's activities are on-going. Upon occurrence of any accident or irregularity, the health and safety manager shall report in wiring to the Engineer and/or the relevant authorities of jurisdiction.

The Contractor shall ensure that the Contractor's Personnel on the Site are all fully aware of and trained on the health and safety practices set out in the health and safety management plan.

The Contractor shall ensure that all precautions are taken to safeguard the general public in and around the Site. All live electrical equipment shall be properly grounded, notices shall be displayed properly on the use of high voltage electrical equipment, laser equipment and the similar equipment harmful to the general public in the vicinity.

All part of the Works completed or in progress on the Site shall be safeguarded or protected by way of temporary fencing, barricading, lighting, covering, sign-boarding and the like as appropriate. These provisions shall be adequate and in full compliance with the applicable Laws.

The Contractor shall provide the Contractor's Personnel and the Contractor's guests and visitors on the Site with appropriate safety gears and protective clothing including hard hats and safety shoes, and make sure that the safety gears and protective clothing are worn by them while they are on the Site. No shoes other than proper safety shoes will be allowed on the site. The Employer and the Engineer shall be responsible for health and safety of their guests and visitors on the Site, including provision of safety gears and protective clothing in a similar manner.

The Contractor shall accept on or in the vicinity of the Site and attend to the inspectors of the relevant authorities of jurisdiction, such as fire department and health and safety department in charge of the Project site, whenever they need to ensure the Contractor's compliance with the applicable Laws from time to time during the execution of the Works.

8.7 Environmental Protection

The Contractor shall minimize, as far as is practicable, the adverse effects of all his and the Subcontractors' activities upon the environment throughout the execution of the Works. The Contractor shall implement and monitor, and cause the Subcontractors to implement and monitor, the implementation of the necessary measures to prevent and/or mitigate the following adverse effects:

a. contamination of surface and ground waters including lakes by spillage or discharge of contaminants such as oil, muck, chemical and sewer;

b. emissions into air of polluting gases, including engine exhaust gases and smokes;

c. contamination of soil by unsanitary or unsafe storage or discharge of oil, sewer, solid waste, etc;

d. erosion of ground surface by rainwater run-off, etc;

e. noise;

f. visual intrusion; and

g. waste of energy and water.

The Contractor shall be deemed fully aware of the Employer's and Contractor's duties,

responsibilities and obligations regarding the environmental protection and mitigation laid down in the environmental management and monitoring documents for the Project and the applicable Laws, and all of the costs of the Contractor shall be deemed included in the Accepted Contract Amount.

These requirements, duties, responsibilities and obligations shall be met through the constant and careful attention of the Contractor's management of all activities within or in the vicinity of the Site and the proper instruction to the Contractor's Personnel in these matters.

The Contractor shall assign on the Site an Environmental Specialist and his alternate(s), who shall be primarily responsible for the Contractor's environmental protection services.

Within twenty-eight (28) days of receipt of the Letter of Acceptance, but in no case later than the Commencement Date, the Contractor shall prepare and submit to the Engineer for approval an environmental management plan to comply with the environmental protection and mitigation requirements. The environmental management plan shall in principle be in general compliance with ISO 14001 and include, but not be limited to, the Contractor's proposed arrangements for measurement of environmental impacts, planning and implementation of impacts mitigation measures, monitoring, testing and reporting of the relevant activities, and the proposed organization chart of the Contractor's environmental management function showing the key positions and the job descriptions. All potentially affected areas within and in the vicinity of the Site, as agreed with the Engineer, shall be covered by the environmental management plan.

All reports shall be in writing and submitted on a monthly basis as part of the Monthly Progress Reports specified in this Section of the Specification. Ad-hoc reports shall be prepared and submitted as and when the Contractor considers necessary or directed by the Engineer. The monthly reports shall include at least a listing of testing, measuring and monitoring conducted, the test results and measurements, the mitigation measures taken, and a monthly summary of the Contractor's environmental management activities on all aspects listed above.

The Contractor shall provide all measuring equipment, necessary for monitoring, testing and accurately measuring the environmental impacts for all aspects listed above, all to the approval of the Engineer.

The Contractor shall take all measures and precautions to prevent any nuisance or disturbance arising from the execution of the Works including operation of the Contractor's Equipment. The Contractor shall in particular but without limitation:

a. wherever practicable, suppress the nuisance at source rather than abate or mitigate the nuisance once generated. This pertains to nuisance from, for example, noises, dusts, smokes and odours;

b. select and operate the Contractor's Equipment so as to minimize the nuisance or disturbance;

c. design and maintain all relevant items of Contractor's Equipment so as to minimize the risk of silt and other contaminants being released into waters; and

d. repair promptly all pipe leakages and refrain from using the Contractor's Equipment which leaks or releases excessive contaminants.

The Contractor shall ensure that all hazardous materials and hazardous wastes are properly and safely handled and controlled at all times, from their acquisition or production to their final disposal, in a lawful manner. Materials of particular concern are radio-actives, fuel oil, lubricating oil, solvents, contaminated containers, absorbent materials and paints.

The Contractor shall identify and segregate all construction waste materials suitable for reuse

or recycling, for sale or disposal as the Contractor may propose. All construction waste materials deemed unsuitable for reuse or recycling, and all other waste materials related to construction, shall be disposed of by the Contractor in accordance with the requirements of the Contract and the applicable Laws. Except where otherwise specified, these materials belong to the Contractor under the Contract. The Contractor shall, where applicable, comply with all acceptance criteria and other conditions of any license for disposal of construction waste materials at public landfills or dumps. The Contractor shall in no case be allowed to burn any construction waste materials on the Project site.

8.8 Setting Out of the Works

The Contractor shall be responsible for setting out the Works. The Contractor shall submit to the Engineer for review a copy of professional license or registration of the surveyors responsible for the setting out of the Works, within twenty- eight (28) days of receipt of the Letter of Acceptance, but in no case later than the Commencement Date. In no case the survey or setting out activities shall be undertaken by any person who is not properly licensed or registered.

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The Contractor shall establish and maintain additional benchmarks of approved design in such a way that the distance between adjacent benchmarks does not exceed 200 meters. All of the benchmarks so established shall bear the coordinates and level information written legibly thereon. The Contractor shall protect these benchmarks as required for execution and completion of the Works within the specified tolerances.

The Contractor shall maintain at his site office all survey records duly signed, for accuracy, by the surveyor responsible for the setting out of the Works. The Contractor shall, as soon as practicable, supply to the Engineer in approved forms the setting out records if so directed by the Engineer.

The Contractor shall carefully preserve and protect all survey reference pegs except where construction requires their removal, and the Contractor shall obtain the Engineer's approval before the removal is made. The Contractor shall replace all damaged or displaced reference pegs immediately.

The Contractor shall survey the existing ground levels in a manner agreed with the Engineer before disturbing the existing ground and send the records to the Engineer. The records shall be used as the basis for measurement of the Works where applicable.

The Contractor shall, at all times during the execution of the Works, maintain in his site office the necessary equipment for his use in setting out the Works. The Engineer and his staff shall be allowed to use these equipment free of charge as and when necessary to check the setting-out.

If reasonable doubt arises as to the accuracy of work done by any of the Contractor's surveyors, the Employer may employ another surveyor to verify previous work done by the Contractor's surveyor. Costs of such verification shall be borne by the Contractor if any error is found in the Contractor's surveyor's work.

8.9 Payment to Contractor's Management of the Work

The following documents and activities for the Contractor's management of the Works as specified above are included in the unit price of each item in BOQ. Therefore, no specific payment for these activities will be made. :

a. Quality Assurance Plan

b. Environmental Management Plan

c. Environmental Protection, and

d. Progress Reports

Section 9 – Contractor's Drawings

9.1 Responsibilities

This Section covers the drawings to be prepared and submitted by the Contractor other than the Contractor's design drawings.

No approval by the Engineer of any drawing submitted by the Contractor shall relieve the Contractor of any of his responsibilities or liabilities under the Contract.

The Contractor's drawings specified herein shall include, but not be limited to, the shop drawings, coordination drawings and as-built drawings forming part of the Contractor's Documents.

The Contractor's drawings shall be provided as and when necessary for the proper execution, completion, testing and as-built recording of the Works or any part thereof.

The Contractor's drawings shall be prepared in a format acceptable to the Engineer. The Contractor shall submit the proposed format within twenty-eight (28) days of the Commencement Date. The drawings shall be drawn to scale, preferably on A1 size sheets. All of the Contractor's drawings shall be in English with translation in Indonesian. Where practical, translations in Indonesian may be shown below the English original texts.

Upon receipt of the further Drawings or documents from the Engineer and prior to the Contractor's use of the information contained therein for preparation of the Contractor's drawings or other Contractor's Documents, the Contractor shall examine them carefully and advise the Engineer in writing of any errors, discrepancies, ambiguities and the similar defects found therein.

The costs of shop drawings and as-build drawings of the Works as specified hereinafter are included in the unit price of each item in BOQ. Therefore, no specific payment for these activities will be made.

9.2 Shop Drawings – Schedule

The "shop drawings" shall be understood to include drawings for further development of the Employer's design, manufacture/fabrication drawings to be prepared by the suppliers/manufacturers, Contractor's working drawings including those for the Temporary Works, and other detailed drawings of similar nature and/or purpose. The Contractor shall note that, where necessary for the Engineer's comprehensive review of the shop drawings, the relevant coordination drawings as specified below shall be submitted together with the shop drawings.

Within twenty-eight (28) days of the Commencement Date the Contractor shall submit to the Engineer for review and comment five (5) printed copies of a proposed schedule of shop drawings indicating at least the following:

a. drawing categories;

b. section titles;

c. drawing titles and numbers (preliminary);

d. planned submission date; and

e. planned date for completion of the Engineer's review.

In preparing the above schedule, the Contractor shall ensure that a minimum period of twenty-eight (28) days for each submission is allowed for the Engineer's review, comment or approval. The Contractor shall also allow sufficient time for modification, correction and re-submission where so required by the Engineer. This process of resubmission shall continue until the drawing is approved by the Engineer, provided that the Contractor may be allowed to proceed with the Works upon the relevant drawings reach the "Approved with Conditions" status.

This schedule shall be updated on a monthly basis and submitted to the Engineer, in 5 copies, for his review and comment. This submission should include where possible:

a. the actual drawing title, number and revision number as and when they are known;

b. the Contractor's drawing preparation status;

c. revised planned dates for submission or re-submission; and

d. status of all submissions.

Any failure of the Contractor to list any shop drawings in the Schedule will not relieve him of his responsibility to submit all required shop drawings in a timely manner.

9.3 Shop Drawings - Particular Requirements

The Contractor shall furnish to the Engineer all Contractor's, and Subcontractor's Shop Drawings. Shop Drawings shall be deemed to include design drawings, fabrication drawings, catalogue cuts, brochures, illustrations, material lists, design calculations, reference standards and performance data which may be required by the specification necessary for the proper execution of the Work, or as otherwise required by the Engineer for assurance that there is intent to meet the requirements of the specifications. All Shop Drawings shall be in English and with translation in Indonesian.

The Contractor shall submit shop drawings in a timely manner when and where the Contract considers it necessary or as instructed by the Engineer.

The Contractor shall return to the Subcontractors for correction such Shop Drawings that are found inaccurate or otherwise in error. After the Contractor has checked and approved such Shop Drawings he shall place thereon the date of such approval and the legible signature of the checker, and shall then submit them to the Engineer for review. The Engineer may refuse to check or review any Shop Drawings that are not submitted in compliance with the foregoing requirements.

The shop drawings shall be developed in strict accordance with the Works requirements set out in the Drawings, the Specification and the Contractor's design documents to be submitted, and shall clearly show all working details for procurement, manufacture, fabrication, assembly and construction or installation for all elements and parts of the Works.

Descriptive brochures that are applicable shall be included for information. Any notation on the Shop Drawings which is on the prints and not on the original from which the prints were made shall be highlighted in colored ink.

All shop drawings shall be prepared in an approved CAD format and submitted to the Engineer in five (5) printed copies.

All shop drawings submitted, including those produced by the Subcontractors, manufacturers or suppliers, shall be reviewed and signed by the Contractor's Representative and a responsible person in the Contractor's quality assurance department on the Site, to warrant

that the Contractor has verified the adequacy of the shop drawings submitted and accepts all responsibilities pertaining thereto. Any shop drawing which has clearly not been reviewed by the Contractor as set out below and/or does not bear the signatures as aforesaid may be returned to the Contractor without the Engineer's review.

The submitted shop drawings shall be reviewed, commented, approved or otherwise by the Engineer and will be returned to the Contractor within twenty-eight (28) days after the Engineer's receipt of the submission, indicating the appropriate status.

9.4 As-built Drawings

The Contractor shall prepare throughout the progress of the Works and keep up-to-date the "as-built" drawings of the Works as part of the Contractor's Documents. These drawings shall show all changes or revisions from the original Drawings, and show the exact "as-built" field-measured conditions of the Works.

The master copy of these drawings shall be kept by the Contractor on Site for the inspection of the Engineer whenever needed and shall be used as a record set for ad hoc entering of the changes made to the Works. The originals of the as-built drawings shall be promptly revised to reflect these entries made.

At the end of every month, or such other times as the Engineer may instruct, three (3) hard copies of the originals of the as-built drawings reflecting all entries made to the master copy shall be submitted to the Engineer for review.

Prior to issue of the Taking-Over Certificate for the whole of the Works or any Section or part thereof, the Contractor shall submit to the Engineer, copies of the final version of the as-built drawings for the approval of the Engineer. These drawings shall have been fully checked by the Contractor and certified as stated below. Most of the final version of the as-built drawings shall be submitted to the Engineer progressively and at least twenty-eight (28) days before the date of the Taking-Over Certificate for the whole of the Works. Minor portion thereof may be submitted at least fourteen (14) days before the date of the Taking-Over Certificate.

The Works shall not be considered to be complete for the purposes of Taking-Over Certificate until the final version of the as-built drawings has been approved by the Engineer in writing.

The final version of the as-built drawings shall accurately show the Works as constructed, incorporating the effect of all Site changes, Variations and instructions and will particularly highlight and detail the locations, elevations, sizes, dimensions, the materials used and the workmanship applied in the Works including all plant and equipment inclusive of pipes, ducts, cables, wires and the like, for the convenience of the operation and maintenance personnel. Accuracy of the as-built drawings shall be certified by a responsible person in the Contractor's quality assurance department on the Site.

After approval by the Engineer, these drawings shall be securely bound by the Contractor into separate volumes, with covers and contents pages added, as agreed with the Engineer. Final submission shall be made to the Engineer for transmission to the Employer.

The following copies of the final version of the as-built drawings, in English with translation in Indonesian (original wording in English with translation in Indonesian written alongside is acceptable), shall be submitted to the Engineer by the time set forth above.

a. Full size (A-1) hard (printed) copy : three (3) sets

b. Reduced size (A-3) hard copy : five (5) sets

c. Soft (electronic) copy on Compact Disks : one (1) set

The review and approval by the Engineer or by the Employer of the "As-Built" Drawings does not relieved the Contractor of any responsibility for and/or liabilities arising out of inaccurate, false or otherwise incorrect "As-Built" Drawings prepared and submitted by the Contractor.

Section 10 – Method Statements of Works

Before the Contractor starts work on any part of the Works, either design or construction of either the Permanent Works or the Temporary Works, detailed method statements for that work shall be submitted to the Engineer for review and/or approval.

The method statements shall in principle be based upon the construction plan submitted with the Bid. Whenever the method must be changed, the method statements shall be revised accordingly and resubmitted to the Engineer.

The method statements shall contain the following information as a minimum:

a. location and type of construction or installation activity;

b. Temporary Works to be used;

c. Contractor's Equipment to be used;

d. Plant and/or Materials to be used;

e. the proposed sequence of operations;

f. structural stability of permanent and temporary Works

g. quality control procedures;

h. safety and environmental protection measures to be used and enforced; and

i. transportation route for the Goods, if applicable.

Adequate provisions shall be included in the method statements for all necessary inspections and tests to be carried out and the Engineer's approvals given during the activities covered by the respective method statements.

Approval by the Engineer of any of the further documents submitted by the Contractor shall not relieve the Contractor of any of his responsibilities and liabilities under the Contract.

Method statements shall be submitted to the Engineer no later than twenty-eight (28) days before the Engineer's response thereto is expected.

Section 11 - Workmanship, Plant and Materials

11.1 General

The workmanship for the Works shall be performed to the specified level or standard of quality.

All of the Contractor's Personnel shall be properly experienced, qualified and able in their respective skills. The Contractor's Personnel may be called upon by the Engineer to demonstrate their experience and ability. If such demonstration fails to satisfy the Engineer, the Contractor shall remove immediately from the Site such person, at the Contractor's cost. The Contractor shall ensure and cause that all of the Subcontractors observe and comply with these conditions.

All Materials used in the Works shall be of the qualities and types or kinds specified in the Contract and equal to the approved samples where prior approval of the samples are required by the Specification or instructed by the Engineer.

Delivery to the Site of Materials shall be made sufficiently in advance to enable the samples to be taken and tested on the Site if required. No Materials shall be incorporated into the Permanent Works until the Engineer's approval is granted, and all Materials disapproved shall immediately be removed from the Site at the Contractor's expense.

The Contractor shall produce, as and when instructed by the Engineer, certificates of origin, names and addresses of suppliers and proofs of purchase of the Plant and/or the Materials intended for incorporation into the Permanent Works.

All Plant and/or Materials shall be transported, handled, stored and protected on the Site or elsewhere in such manner as to prevent damage, deterioration or contamination, all to the satisfaction of the Engineer. The Engineer reserves the right to inspect, or cause other Employer's Personnel or agents to inspect, any of the Plant or the Materials to be incorporated into the Permanent Works at any time and at any place of manufacture or storage.

All of the Plant and/or the Materials which are required to conform to particular specified standards shall bear the approved/certified marks of the relevant standards or have certificates attached thereto, evidencing their compliance with the specified standards.

Wherever the Plant or the Materials are specified by proprietary name, those substitute Plant or Materials equal to or better than the named proprietary products, as determined by the Engineer at his sole discretion upon consultation with the Contractor, shall be acceptable under the Contract.

Within fifty-six (56) days from the Commencement Date, the Contractor shall prepare and submit to the Engineer for review and for subsequent monitoring of the procurement work progress, as instructed by the Engineer, the proposed procurement time schedule for all of the Plant and/or the Materials to be imported from eligible source countries and for those to be procured from domestic market. The schedule shall contain name of the Plant or Materials, source country, name of the supplier if possible, planned dates of shipping/ex-factory and arrival on the Site, locations of storage place and other information as appropriate. This schedule shall be fully compatible with the Contract Programme and the Working Programme to be prepared and submitted by the Contractor.

Approval by the Engineer of any workmanship or any item of the Plant or the Material shall not relieve the Contractor of any of his responsibilities and liabilities under the Contract.

11.2 Qualification of Manufacturers

The proposed manufacturers shall have been regularly manufacturing the material, equipment or Plant of the same or similar type to that to be manufactured or supplied for the Works for at least the last ten (10) years.

The types of the Material and/or the Plant proposed for the Engineer's approval for incorporation into the Permanent Works shall have been in commercial service with satisfactory performance, as evidenced by one of the customers in writing if so instructed by the Engineer.

In order to expedite the inspection, sampling and testing of materials and/or Plant, the Contractor shall notify the Engineer of his proposed sources of materials and/or Plant prior to delivery. If it is found after trial that sources of supply for previously approved materials do not produce the specified products, the Contractor shall furnish materials from other approved sources. If there are suggested sources of local materials, the quality of materials in

such suggested sources will be acceptable in general, but the Contractor shall determine for himself the equipment and work required to produce material meeting the specifications. It shall be understood that it is not feasible to ascertain from samples the limits of an entire deposits and that variations shall be considered as usual and to be expected. The Engineer may order procurement of materials from any portion of a deposit and may reject portions of the deposit as unacceptable

If the material is to be purchased by the Contractor from suppliers, the Contractor shall, before placing order for materials, manufactured articles and machinery to be a part of permanent works, submit for approval of the Engineer, a complete description of such items, the names of the firms from whom he proposes to obtain such items, together with a list of the items he proposes each firm would supply.

No materials, manufactured articles or machinery shall be ordered from any firm without the written approval of the Engineer. When directed by the Engineer or otherwise specified in the Contract, the Contractor shall submit samples for approval. If it is found after trial that sources of supply for previously approved materials, manufactured articles, or machinery do not produce specified products, the Contractor shall furnish the items from other sources approved by the Engineer.

No material, regardless of its source, shall be incorporated in the Work until representative samples taken by the Contractor and tested in an approved laboratory or tested by the Contractor in the presence of the Engineer, have been approved and written authority is issued by the Engineer for the use thereof.

11.3 Suitability of Specified Plant or Materials

The Contractor shall immediately refer to the Engineer for clarification any requirement shown or specified which he considers or believes:

(a) is not equal or equivalent to the normally accepted good industrial standards or does not achieve the quality of installation specified or intended under the Contract;

(b) is below standards for proper enforcement of warranties or guarantees required; and/or

(c) is at variance with the applicable Laws.

11.4 Manufacturers' Guarantees

The Contractor shall obtain written warranties or guarantees from manufacturers and suppliers of all items of the Plant and the Materials, and the installations undertaken by them. The Contractor shall ensure that these are in such a form that the benefits offered thereby can be passed to the Employer.

Wherever possible, these warranties and guarantees shall be obtained and submitted as part of the Contractor's initial request for approval of the respective items of the Plant, Materials or installation. For the substitutes, these shall be submitted along with the respective substitution proposals.

11.5 Requests for Approval

When making submissions of requests for approval to the Engineer, the Contractor shall comply with the formal procedures of the Engineer, regarding format, numbering and content of submissions. In this respect the Contractor is referred to Section 5 of the Specification.

All requests for approval submitted by the Contractor shall be clear and comprehensive to readily permit full and detailed review by the Engineer. The submissions for items of Plant or

Materials shall, therefore, include the following enclosures, prior to ordering, manufacture or fabrication:

a. full documentary description, with manufacturer's original brochures;

b. compliance listings, showing, in simple tabulated form, a listing of all pertinent items of the Specification compared with the proposed item, indicating "yes" or "no" for each;

c. results of testing to demonstrate compliance with requirements;

d. shop drawings and coordination drawings;

e. manufacturer's guarantee;

f. proposed schedule and methodology for any related factory and on-site tests proposed; and

g. list and details of entities in Vietnam capable of providing maintenance and repair services and/or supplying spare parts, consumables and tools.

The Contractor shall allow the Engineer at least twenty-eight (28) days for his review and response to any submitted request for approval.

The Contractor shall be responsible for the consequences of inadequate or late submissions and resubmissions.

11.6 Delivery to Site and Storage

The Plant and/or the Materials shall be delivered to the Site at the most suitable times for the Programme requirements in accordance with the procurement time schedule set forth above, to minimize undue damage and deterioration during the excess storage periods.

All of the Plant and/or the Materials, if manufactured or assembled off the Site, shall be properly and securely packed at the origin, in order to prevent damage during transport to the Site and storage in the tropical environmental conditions of the Site.

The Contractor shall, crate or box all consignments for ocean shipment in a manner suitable to protect them from damage in transit, and shall be responsible for and rectify any and all damage due to improper packing. Crates shall have external markings identifying the Contract reference number, origin, destination, contents and consignee.

The Contractor may be required to furnish the Employer, by air mails, etc, with advance copies of shipping documents, invoices and other pertinent papers showing the date and origin of shipment, a description of the goods, the shipping weight of each item, destination, name of the vessel and other pertinent information.

Trans-shipment of Goods, until safely delivered to the installation sites, shall be the sole responsibility of the Contractor.

The Contractor shall ensure, before the Plant or the Material arrives, that adequate storage on the Site is available to properly store and protect the Plant or the Material in order to prevent damage or deterioration. The Materials of inflammable, explosive, toxic or similar hazardous nature shall be stored separately from others, at the approved locations. These locations shall be under the tight security and safety control throughout the storage period. Before delivering these Materials to the Site, all necessary permits and licenses shall be obtained from the authority of jurisdiction in accordance with the applicable Laws.

When the Plant or the Material arrives on the Site it shall be immediately inspected by the Contractor in the presence of the Engineer, for damage or deterioration. The Contractor shall be responsible for unpacking and re-packing in an appropriate manner and for provision of all necessary equipment and tools at his own expense. If damage or deterioration has

occurred as determined by the Engineer, the payment for the Plant or Material arrived on the Site shall not be made for such damaged or deteriorated Plant or Material, and such particular Plant or Material shall be removed from the Site, repaired or replaced according to the instructions of the Engineer. For the Plant or the Material which is subject to deterioration after opening the packing, appropriate alternative inspection measures shall be determined on Site between the Engineer and the Contractor. No payment shall become due to the Contractor for those uninspected Plant or Material, unless otherwise determined by the Employer.

The packing materials shall remain the property of the Contractor and be removed from the Site immediately when the materials are no longer required on the Site as determined by the Engineer.

The Contractor shall be responsible for the safe and secured storage and handling of the Plant and/or the Materials on the Site until the issue of the Taking-Over Certificate for the relevant part of the Works, regardless of any intermediate transfer of the ownership thereof to the Employer.

Any action taken by the Engineer in the inspection of such Plant or Material upon arrival on the Site or any determination made by the Engineer subsequently shall not relieve the Contractor of his responsibilities under the Contract.

11.8 Applicable Standards and Codes

The standards and codes described in the Specification, shown on the Drawings or otherwise referred to in the Contract are those applied to the design, materials and workmanship of the Works in the Employer's design. In general, the standards referred to for the Works are the Japanese Industrial Standards (hereinafter "JIS") or equivalent, and the Indonesian Standards, all of them will be unconditionally acceptable to the Engineer for the Contractor's use. Where reference is made in the Contract to a particular standard or code, the requirements and/or recommendations of the said standard or code shall be considered a minimum level of quality standard applicable to the respective Goods and/or the workmanship. Where reference is made to two or more standards or codes in parallel, the Engineer shall have the right to apply the more stringent one, and the Accepted Contract Amount shall be deemed to have allowed for such decision of the Engineer. Where there is a conflict or discrepancy between the requirements of the referenced standards or codes, the Engineer shall determine the governing requirements on the principle that the higher or severer requirements shall govern.

For the purpose of the Contract, and where the applicable standards or codes are not described in the Specification or shown on the Drawings, the following standards and codes will in principle be acceptable to the Engineer, in addition to the above-mentioned JIS or equivalent, and the Indonesian Standards :

ASTM : American Society for Testing and Materials

BS : British Standard

ISO : International Organization for Standardization

JSWA : Japan Sewage Works Agency, and

JSWA : Japan Sewage Works Association

Unless otherwise expressly stated, the latest published version of the respective standards and codes shall apply.

Other standards and codes may be acceptable as substitutes of these standards and codes referred to in the Contract, provided that the Contractor can demonstrate to the approval of

the Engineer that the standard or code proposed by the Contractor as a substitute is equal to or better than the standard or code referred to in the Contract. The Goods and the workmanship of the Works meeting such approved substitutes shall in principle be acceptable under the Contract.

Whenever the Contractor wishes to propose a substitute to any standard or code referred to in the Contracts, the Contractor shall submit to the Engineer for review the proposal including all information and data necessary to demonstrate that the proposed substitute is equal to or better than the standard or code referred to in the Contract. Differences between the referred standard or code and the proposed substitute shall be fully and clearly described in the proposal. The Contractor's attention is drawn above, for the Engineer's treatment of excessive proposal and the Cost adjustments.

The Engineer shall promptly review the Contractor's proposal documents and inform the Contractor of his decision whether the proposed substitute is acceptable or otherwise. The Contractor may submit the second proposal when the fist proposal was not accepted, provided that the agreed time schedule of the Works including the Time for Completion and milestones, if any, will not be adversely affected. No third proposal will in principle be entertained by the Engineer.

The Engineer shall have the right to demand the Contractor to submit supplementary information and/or data, including copies of the relevant standards or codes, which he considers indispensable for determining the acceptability or otherwise of the proposed substitutes. The 28-day period mentioned below shall begin when the Engineer received from the Contractor the complete proposal, including all necessary documents, data and/or supplementary information.

Unless another response period is agreed in advance between the Engineer and the Contractor, the Contractor's substitution proposal shall be deemed approved by the Engineer without any conditions upon expiration of the response period of twenty eight (28) days after the Engineer's receipt of the complete proposal. Where the Engineer does not accept the substitute, the Contractor shall comply with the standard or code referred to in the Contract.

The Contractor shall obtain and keep in the Contractor's temporary office on the Site one (1) hard copy each of all particular standards and codes specifically list or shown in the Contract, within twenty-eight (28) days from the Commencement Date. Copies of the subsequently approved standards and codes shall be added to the archive without delay. The Engineer shall be allowed to have free accesses to these copies as and when needed. When further standards and codes are accepted by the Engineer as stated above, the above requirements shall apply to these standards and codes, but within seven (7) days after the Contractor's receipt of the Engineer's notice of acceptance of the respective standard or code.

Section 12 - Tests and Inspections

12.1 General

The whole of the Works is subject to tests and inspections by the Engineer, during manufacture, execution, installation and completion at the Site or such other places as designated by the Engineer, to be conducted:

a. when such tests and/or inspections are required under the Conditions of Contract, the Specification or the applicable Laws; or

b. when such tests and/or inspections are indispensable, as judged by the Engineer, to certify that the performance conforms with the requirements of the Contract.

The Contractor shall give the Employer's Personnel full opportunity to carry out these activities, including providing access, facilities, permissions and safety equipment.

Further tests, inspection and the associated work shall be conducted, at the Contractor's expense, in the following circumstances:

a. modifications/changes, repair or replacement of the work failed to pass the specified test or inspection in the previous test or inspection; and

b. re-testing, additional testing or re-inspections became necessary due to failure of the previous test or inspection, or for other reasons which indicate that the work did not comply with the requirements of the Contract; and/or

c. repair or replacement of the work damaged or adversely affected by the re-testing or additional testing.

The Contractor shall prepare and submit to the Engineer for approval a general testing and inspection programme for the Works, within fifty-six (56) days of the Commencement Date, or such other earlier times as agreed with the Engineer for those tests or inspections to be conducted before the said submission deadline. This general testing programme shall include a list of the tests to be carried out by the Contractor's own laboratory, if any, and the tests to be undertaken by independent testing agencies proposed by the Contractor.

The Engineer shall be given the opportunity of witnessing all tests conducted by the Contractor under the Contract, and the Contractor shall give at least seven (7) days prior written notices for all tests, with exception of the factory tests described below and the Tests on Completion to which the rules of 21 day's notice shall apply. The Engineer shall put his signature on the records of the tests or inspections he witnessed.

The approval of the Engineer of any inspection or test results shall not prejudice the right of the Engineer to reject the Plant, the Material or the workmanship that has passed the inspection or test, if the same is subsequently determined to be not complying with the requirements of the Contract.

Any additional or supplementary tests and inspections may be carried out by the Engineer, at his discretion, whenever the Engineer considers such tests and inspections indispensable for proper completion of the Works. The Contractor shall supply the Engineer with sufficient quantities of test specimens for these tests.

Tests and inspections under the Contract shall be carried out on or in the vicinity of the Site to the maximum extent practicable, for the convenience of the Engineer's attendance thereto and the costs thereof shall be borne by the Contractor. All costs of travelling and any necessary accommodation for the Engineer's attendance to the tests and inspections, including re-tests and re-inspections became necessary due to failures of the previous tests or inspections but excluding the additional or supplementary tests or inspections, to be carried out off the Site shall be borne by the Contractor and shall be deemed included in the Accepted Contract Amount.

Except where testing at the Contractor's laboratory on the Site is specified in the Contract or accepted by the Engineer in writing in advance, all tests on the Materials and workmanship on the Site shall be performed by independent registered/licensed testing agencies approved by the Engineer. The Contractor shall prepare or obtain from the testing agencies and submit them to the Engineer for approval, no later than twenty-eight (28) days before the respective proposed testing day, the proposed test method statements properly referring to the standards and codes of practice applicable to the tests and approved by the Contractor's personnel in charge of quality assurance. For repetition of same tests under the same method, no repetitive submission is required.

The Contractor shall provide all necessary test specimens and consumables required for the

tests and deliver them to the places of the tests, in sufficient quantities and at the appropriate time for testing, with all necessary cutting, machining, labeling and other preparation completed. Wherever possible for the factory-assembled or produced Plant or the Materials, the factory test results shall be submitted to the Engineer with the Contractor's request for approval of the respective item of the Plant or the Material concerned.

The Contractor shall provide sufficiently qualified personnel, materials including consumables, properly calibrated/certified testing equipment, instruments and tools, safety measures and utilities required for the testing, at the Contractor's own cost.

The Contractor shall supply to the Engineer any certificates of compliance with the relevant standards and codes of practice for the testing method, equipment and instruments to be used for the tests. The proposed sample recording forms for all readings and measurements conforming to the standards or the codes shall be submitted at the same time.

Records of all tests and inspections, including the measurement and change/modification records and photographs as appropriate, shall be compiled in an approved format, certified by signatures of authorized independent service agencies as needed and submitted promptly to the Engineer. Except where otherwise specified in the Contract or instructed by the Engineer, three (3) hard copies and one (1) PDF copy on a diskette shall be submitted to the Engineer within seven (7) days after completion of the tests or inspections.

If any part of the Works fails to pass the specified or required tests or inspections, the Contractor shall investigate the cause of the failure and report to the Engineer for discussion of the modification, change and/or rectification measures to be taken before the re-testing. The Contractor shall carry out, at his own expense, the modification, change and/or rectification measures as agreed with the Engineer. If any part of the Works continues to fail after such agreed measures taken, the Contractor shall replace the failed part of the Works with the acceptable substitute and dispose of the failed part from the Site and shall continue to conduct the tests to the satisfaction of the Employer and the Engineer.

For materials whose sampling and testing is not possible after their manufacture, fabrication or preparation as sampling for testing itself is not possible as the utility or structural qualities of the material and/or plant will be adversely affected, it shall be the responsibility of the Contractor to see to it that inspection, sampling and testing are undertaken prior to or during manufacture, fabrication or preparation.

In the event that plant inspection is undertaken, the following conditions shall be met:

a. The Engineer shall have the cooperation and assistance of the Contractor and/or the producer with whom he has contracted for the supply of the materials.

b. The Engineer shall have full entry at all times to such parts of the plant as may concern the manufacture or production of the materials being furnished.

c. Adequate safety measures are to be provided and maintained.

Sampling and quality control testing as well as any check test to verify the quality of materials shall be done by the Contractor at his own expense under the direct supervision of the Engineer. The kind of tests and frequency of testing shall conform to the Minimum Quality Control Testing requirements of the Contract. Sampling and testing shall be in accordance with the methods specified in the item of work in the Specifications, and if not specified, shall conform to the appropriate Japanese Industrial Standards (JIS) or equivalent internationally accepted Standard Test Methods.

All materials shall be inspected, tested and approved by the Engineer before incorporation into the Works. Any untested materials that are used without the approval or written permission of the Engineer shall be at the Contractor's risk. If materials are found to be unacceptable and unauthorized, it shall not be paid for and shall be removed by the

Contractor at his own expense. For materials and/or plant whose sampling and testing is not possible after their manufacture, fabrication, or preparation because sampling and testing shall adversely affect its utility and structural qualities, it shall be the responsibility of the Contractor that such sampling and testing be made at an appropriate time.

In order to expedite the inspection and testing of materials and/or plants and Works, the Contractor shall provide and maintain as part of the Facilities for the Engineer, a field testing laboratory at the project site, as called for in the Specifications and in the Bill of Quantities. The Contractor is required to furnish the testing equipment and provide qualified and experienced laboratory staff who shall conduct the tests under the supervision of the Engineer. The Fabrication Plant to be provided by the Contractor and indicated in the Plans and Specifications shall be furnished with complete equipment, more particularly for pre-cast concrete members, and provided with experienced and qualified laboratory staff who shall conduct the tests under the supervision of the Engineer.

12.2 Factory Tests

At least twenty-eight (28) days before the respective group of factory tests is conducted, the Contractor shall submit to the Engineer the detailed schedule and description of the factory tests to be undertaken. This schedule shall be fully in accordance with the general testing and inspection programme approve.

Factory tests shall be made by the Contractor, or by the manufacturer in the presence of the Contractor. All costs associated with the factory tests shall be borne by the Contractor and deemed to have included in the Accepted Contract Amount. When factory tests are conducted outside the Country, the Contractor shall assign authorized independent service agencies of the respective countries to attend the tests or inspections and to certify the record documents to be submitted to the Engineer. Factory tests conducted in the Country shall be attended by the personnel of the Contractor's quality assurance department to certify the test results on behalf of the Contractor.

At the discretion of the Engineer, factory tests shall be either:

a. undertaken by the Contractor without the presence of the Engineer; or

b. witnessed by the Engineer and other Employer's Personnel.

Tests to be witnessed by the Engineer and other Employer's Personnel shall generally be attended by no more than two (2) persons.

The Employer's Personnel including the Engineer and the independent service agency's personnel assigned to certify the test results shall be allowed to have a reasonable access to all the necessary areas within the factory test site, so that they can witness the tests in a proper manner as needed to certify the test records and results.

Except where an earlier submission is reasonably instructed by the Engineer, the factory test reports shall be submitted to the Engineer within fourteen (14) days of completion of the respective tests, and the reports shall include:

a. completed test records and result summary sheets, and photographs as appropriate, signed by the Contractor and the Engineer or the independent service agency; and

b. records of any engineering modifications/changes made to the Plant or the Material, to comply with the specified requirements of the Contract.

Any of the Plant or the Materials not satisfactorily passed the specified or required factory tests in whole shall not be delivered to the Site.

12.3 Tests on Completion

The Contractor shall prepare and submit to the Engineer for consideration and approval, at least ninety (90) days prior to any of the Tests on Completion being carried out, the proposed detailed test procedures, including the method statements and the proposed schedules for the Tests on Completion. The schedule shall be fully compatible with the approved Working Programme.

Prior to the commencement of the Tests on Completion, the Contractor shall conduct necessary inspections, testing and commissioning of the Works, to ascertain for himself that the completed Works fully comply with the requirements of the Contract.

Only after satisfying himself that the Works does comply with the requirements of the Contract, the Contractor shall apply to the Engineer in writing for the Tests on Completion to be made in the presence of the Engineer according to the requirements of the Contract. The Contractor shall submit to the Engineer five (5) hard copies of the draft as-built drawings and/or the draft operation and maintenance manuals, for the Employer's Personnel's use during the Tests on Completion.

The report on the Tests on Completion shall be submitted to the Engineer within fourteen (14) days of the successful completion of the Tests on Completion as a whole, and shall include:

a. completed test records and result summary sheets, and photographs as appropriate, signed by the Contractor and the Engineer;

b. records of any engineering modifications/changes made to the Works, to comply with the specified requirements of the Contract; and

c. records of any changes to be incorporated into the as-built drawings or the operation and maintenance manuals, as found necessary during the Tests on Completion.

It is probable that permanent power supply will not be available for all tests on the Site during the Tests on Completion. The Contractor shall therefore be responsible to provide all necessary temporary power for such testing of the Works in part or in whole. The Accepted Contract Amount shall be deemed to have included the Cost for such arrangements of temporary power supply for all of the tests required.

ATTACHMENT A

GEOTECHNICAL INVESTIGATION REPORT

ATTACHMENT B

TOPOGRAPHICAL SURVEY REPORT

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

DIRECTORATE GENERAL OF HUMAN SETTLEMENT
MINISTRY OF PUBLIC WORKS
REPUBLIC OF INDONESIA

THE DETAILED DESIGN STUDY

ON

PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA

IN

REPUBLIC OF INDONESIA

DRAFT BIDDING DOCUMENTS

VOLUME 3 :

DRAFT TENDER DRAWINGS

JUNE 2014

NIHON SUIDO CONSULTANTS
NIPPON KOEI
CITY OF KITAKYUSHU

ORIENTAL CONSULTANTS
WATER AGENCY

DRAWING LIST - 1

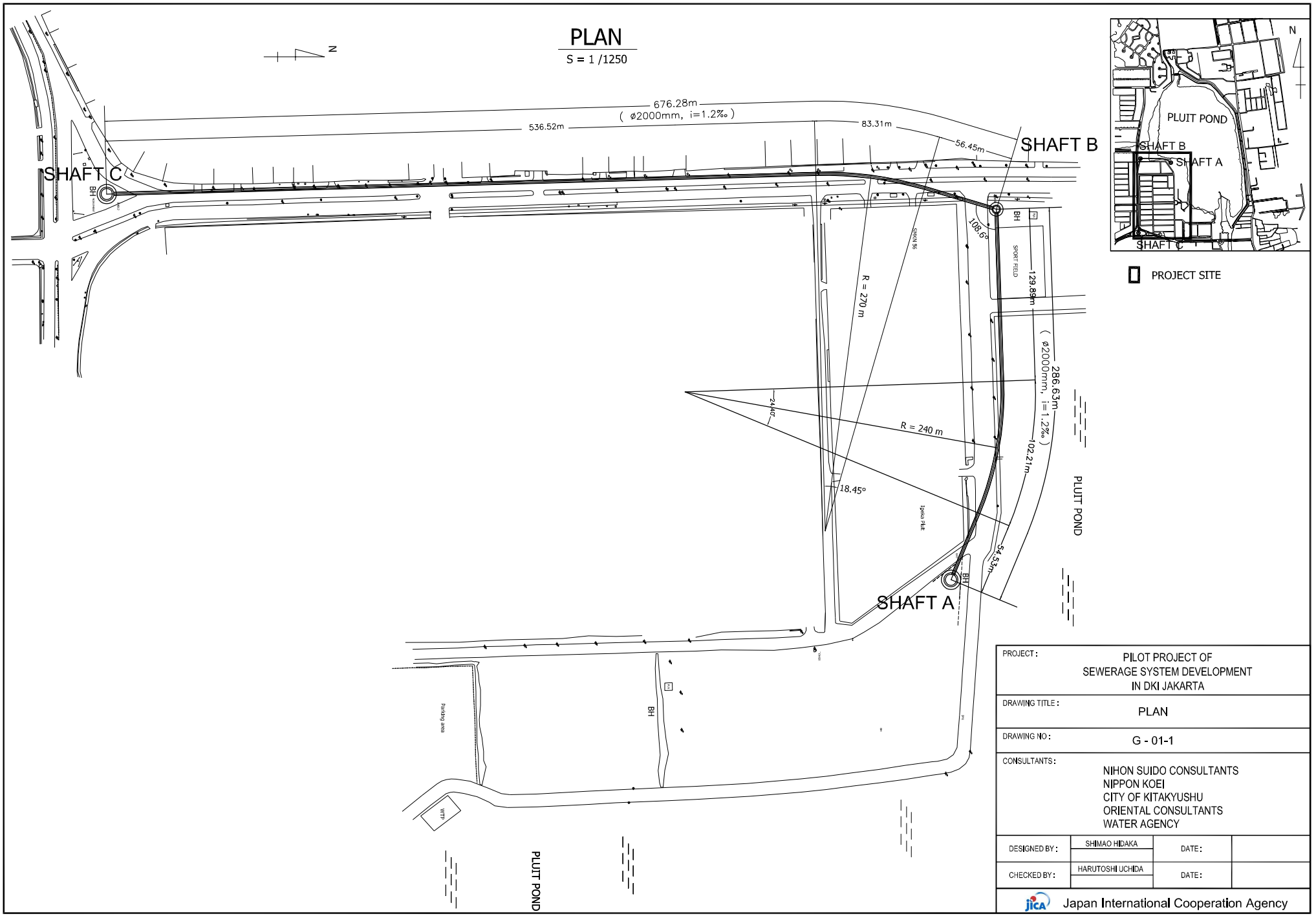
DRAWING NO.	TITLE	SCALE
	GENERAL	
G - 01-1	PLAN	1/1250
G - 01-2	PROPOSED CONSTRUCTION YARD FOR SHAFT (A,B&C)	—
G - 02	PLAN AND LONGITUDINAL PROFILE (C - B)	1/1250 H:1/1250, V:1/250
G - 03	PLAN AND LONGITUDINAL PROFILE (B - A)	1/1250 H:1/1250, V:1/250
G - 04	DEPARTURE SHAFT A	1/50,1/100,1/1000
G - 05	DETAIL OF PROTECTION SHAFT A	1/30, 1/100
G - 06	ARRIVAL SHAFT B	1/50,1/100,1/1000
G - 07	DEPARTURE SHAFT C	1/50,1/100,1/1000
G - 08	DETAIL OF PROTECTION SHAFT C	1/30, 1/100
G - 09	STRUCTURAL DRAWING OF SHAFT A	1/100
G - 10	STRUCTURAL DRAWING OF SHAFT B	1/100
G - 11	STRUCTURAL DRAWING OF SHAFT C	1/100
G - 12	DETAIL DRAWING OF SUBSIDIARY	1/10, 1/30
	RE BAR ARRANGEMENT (SHAFT A)	
RA - 01	RE-BAR ARRANGEMENT OF SHAFT A (1)	1/50
RA - 02	RE-BAR ARRANGEMENT OF SHAFT A (2)	1/50
RA - 03	RE-BAR ARRANGEMENT OF SHAFT A (3)	1/50
RA - 04	RE-BAR ARRANGEMENT OF SHAFT A (4)	1/50
RA - 05	RE-BAR ARRANGEMENT OF SHAFT A (5)	1/50
RA - 06	RE-BAR ARRANGEMENT OF SHAFT A (6)	1/50
RA - 07	RE-BAR ARRANGEMENT OF SHAFT A (7)	1/50
RA - 08	RE-BAR ARRANGEMENT OF SHAFT A (8)	1/50
RA - 09	RE-BAR ARRANGEMENT OF SHAFT A (9)	1/50
RA - 10	RE-BAR ARRANGEMENT OF SHAFT A (10)	1/50
RA - 11	RE-BAR ARRANGEMENT OF SHAFT A (11)	1/50
RA - 12	RE-BAR ARRANGEMENT OF SHAFT A (12)	1/50
RA - 13	RE-BAR ARRANGEMENT OF SHAFT A (13)	1/50
RA - 14	RE-BAR ARRANGEMENT OF SHAFT A (14)	1/50

DRAWING NO.	TITLE	SCALE
RA - 15	RE-BAR ARRANGEMENT OF SHAFT A (15)	1/50
RA - 16	RE-BAR ARRANGEMENT OF SHAFT A (16)	1/50
RA - 17	RE-BAR ARRANGEMENT OF SHAFT A (17)	1/50
RA - 18	RE-BAR ARRANGEMENT OF SHAFT A (18)	1/50
RA - 19	RE-BAR ARRANGEMENT OF SHAFT A (19)	1/50
RA - 20	RE-BAR ARRANGEMENT OF SHAFT A (20)	1/50
RA - 21	RE-BAR ARRANGEMENT OF SHAFT A (21)	1/50
RA - 22	RE-BAR ARRANGEMENT OF SHAFT A (22)	1/50
RA - 23	RE-BAR ARRANGEMENT OF SHAFT A (23)	1/50
RA - 24	RE-BAR ARRANGEMENT OF SHAFT A (24)	1/50
RA - 25	RE-BAR ARRANGEMENT OF SHAFT A (25)	1/50
RA - 26	RE-BAR ARRANGEMENT OF SHAFT A (26)	1/50
RA - 27	RE-BAR ARRANGEMENT OF SHAFT A (27)	1/50
RA - 28	RE-BAR ARRANGEMENT OF SHAFT A (28)	1/50
RA - 29	RE-BAR ARRANGEMENT OF SHAFT A (29)	1/50
RA - 30	RE-BAR ARRANGEMENT OF SHAFT A (30)	1/50
RA - 31	RE-BAR ARRANGEMENT OF SHAFT A (31)	1/50
RA - 32	RE-BAR ARRANGEMENT OF SHAFT A (32)	1/50
	RE BAR ARRANGEMENT (SHAFT B)	
RB - 01	RE-BAR ARRANGEMENT OF SHAFT B (1)	1/50
RB - 02	RE-BAR ARRANGEMENT OF SHAFT B (2)	1/50
RB - 03	RE-BAR ARRANGEMENT OF SHAFT B (3)	1/50
RB - 04	RE-BAR ARRANGEMENT OF SHAFT B (4)	1/50
RB - 05	RE-BAR ARRANGEMENT OF SHAFT B (5)	1/50
RB - 06	RE-BAR ARRANGEMENT OF SHAFT B (6)	1/50
RB - 07	RE-BAR ARRANGEMENT OF SHAFT B (7)	1/50
RB - 08	RE-BAR ARRANGEMENT OF SHAFT B (8)	1/50
RB - 09	RE-BAR ARRANGEMENT OF SHAFT B (9)	1/50
RB - 10	RE-BAR ARRANGEMENT OF SHAFT B (10)	1/50

DRAWING LIST - 2

DRAWING NO.	TITLE	SCALE
RB - 11	RE-BAR ARRANGEMENT OF SHAFT B (11)	1/50
RB - 12	RE-BAR ARRANGEMENT OF SHAFT B (12)	1/50
RB - 13	RE-BAR ARRANGEMENT OF SHAFT B (13)	1/50
RB - 14	RE-BAR ARRANGEMENT OF SHAFT B (14)	1/50
RB - 15	RE-BAR ARRANGEMENT OF SHAFT B (15)	1/50
RB - 16	RE-BAR ARRANGEMENT OF SHAFT B (16)	1/50
RB - 17	RE-BAR ARRANGEMENT OF SHAFT B (17)	1/50
RB - 18	RE-BAR ARRANGEMENT OF SHAFT B (18)	1/50
RB - 19	RE-BAR ARRANGEMENT OF SHAFT B (19)	1/50
RB - 20	RE-BAR ARRANGEMENT OF SHAFT B (20)	1/50
RB - 21	RE-BAR ARRANGEMENT OF SHAFT B (21)	1/50
RB - 22	RE-BAR ARRANGEMENT OF SHAFT B (22)	1/50
RB - 23	RE-BAR ARRANGEMENT OF SHAFT B (23)	1/50
RB - 24	RE-BAR ARRANGEMENT OF SHAFT B (24)	1/50
RB - 25	RE-BAR ARRANGEMENT OF SHAFT B (25)	1/50
RB - 26	RE-BAR ARRANGEMENT OF SHAFT B (26)	1/50
RB - 27	RE-BAR ARRANGEMENT OF SHAFT B (27)	1/50
RB - 28	RE-BAR ARRANGEMENT OF SHAFT B (28)	1/50
RB - 29	RE-BAR ARRANGEMENT OF SHAFT B (29)	1/50
RB - 30	RE-BAR ARRANGEMENT OF SHAFT B (30)	1/50
RB - 31	RE-BAR ARRANGEMENT OF SHAFT B (31)	1/50
RB - 32	RE-BAR ARRANGEMENT OF SHAFT B (32)	1/50
RB - 33	RE-BAR ARRANGEMENT OF SHAFT B (33)	1/50
RB - 34	RE-BAR ARRANGEMENT OF SHAFT B (34)	1/50
RB - 35	RE-BAR ARRANGEMENT OF SHAFT B (35)	1/50
RB - 36	RE-BAR ARRANGEMENT OF SHAFT B (36)	1/50
RB - 37	RE-BAR ARRANGEMENT OF SHAFT B (37)	1/50
RB - 38	RE-BAR ARRANGEMENT OF SHAFT B (38)	1/50

DRAWING NO.	TITLE	SCALE
	RE BAR ARRANGEMENT (SHAFT C)	
RC - 01	RE-BAR ARRANGEMENT OF SHAFT C (1)	1/50
RC - 02	RE-BAR ARRANGEMENT OF SHAFT C (2)	1/50
RC - 03	RE-BAR ARRANGEMENT OF SHAFT C (3)	1/50
RC - 04	RE-BAR ARRANGEMENT OF SHAFT C (4)	1/50
RC - 05	RE-BAR ARRANGEMENT OF SHAFT C (5)	1/50
RC - 06	RE-BAR ARRANGEMENT OF SHAFT C (6)	1/50
RC - 07	RE-BAR ARRANGEMENT OF SHAFT C (7)	1/50
RC - 08	RE-BAR ARRANGEMENT OF SHAFT C (8)	1/50
RC - 09	RE-BAR ARRANGEMENT OF SHAFT C (9)	1/50
RC - 10	RE-BAR ARRANGEMENT OF SHAFT C (10)	1/50
RC - 11	RE-BAR ARRANGEMENT OF SHAFT C (11)	1/50
RC - 12	RE-BAR ARRANGEMENT OF SHAFT C (12)	1/50
RC - 13	RE-BAR ARRANGEMENT OF SHAFT C (13)	1/50
RC - 14	RE-BAR ARRANGEMENT OF SHAFT C (14)	1/50
RC - 15	RE-BAR ARRANGEMENT OF SHAFT C (15)	1/50
RC - 16	RE-BAR ARRANGEMENT OF SHAFT C (16)	1/50
RC - 17	RE-BAR ARRANGEMENT OF SHAFT C (17)	1/50
RC - 18	RE-BAR ARRANGEMENT OF SHAFT C (18)	1/50
RC - 19	RE-BAR ARRANGEMENT OF SHAFT C (19)	1/50
RC - 20	RE-BAR ARRANGEMENT OF SHAFT C (20)	1/50
RC - 21	RE-BAR ARRANGEMENT OF SHAFT C (21)	1/50
RC - 22	RE-BAR ARRANGEMENT OF SHAFT C (22)	1/50
RC - 23	RE-BAR ARRANGEMENT OF SHAFT C (23)	1/50
RC - 24	RE-BAR ARRANGEMENT OF SHAFT C (24)	1/50
RC - 25	RE-BAR ARRANGEMENT OF SHAFT C (25)	1/50
RC - 26	RE-BAR ARRANGEMENT OF SHAFT C (26)	1/50
RC - 27	RE-BAR ARRANGEMENT OF SHAFT C (27)	1/50
RC - 28	RE-BAR ARRANGEMENT OF SHAFT C (28)	1/50
RC - 29	RE-BAR ARRANGEMENT OF SHAFT C (29)	1/50
RC - 30	RE-BAR ARRANGEMENT OF SHAFT C (30)	1/50
RC - 31	RE-BAR ARRANGEMENT OF SHAFT C (31)	1/50
RC - 32	RE-BAR ARRANGEMENT OF SHAFT C (32)	1/50

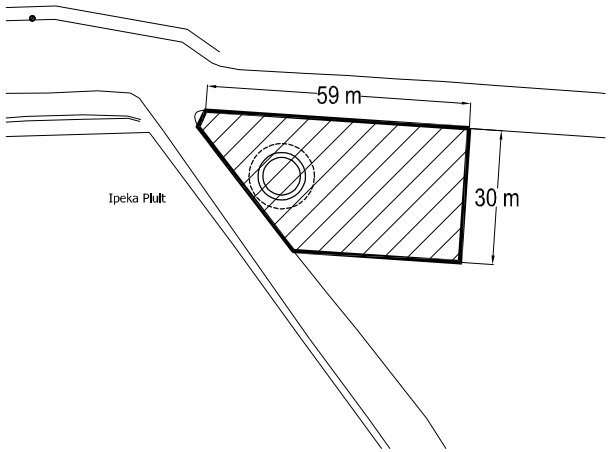
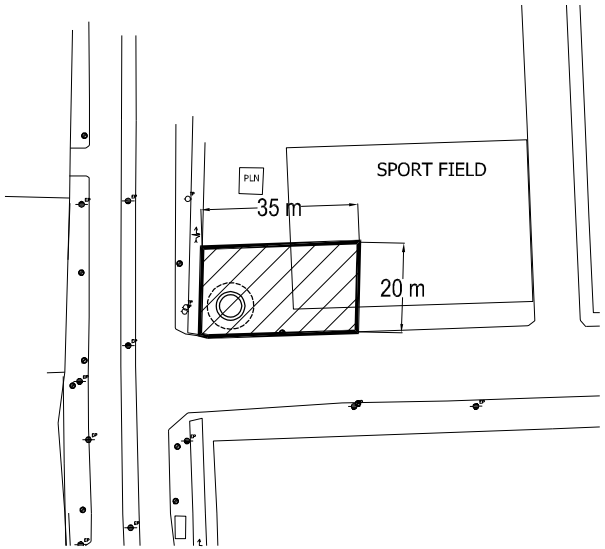
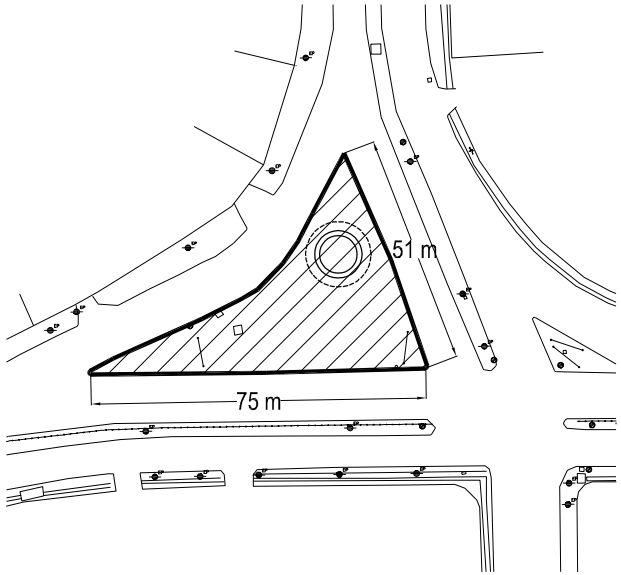


PROJECT :	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE :	PLAN
DRAWING NO :	G - 01-1
CONSULTANTS :	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY

DESIGNED BY :	SHIMAO HIDAKA	DATE :	
CHECKED BY :	HARUTOSHI UCHIDA	DATE :	

Japan International Cooperation Agency

PROPOSED CONSTRUCTION YARD FOR SHAFT (A, B & C)

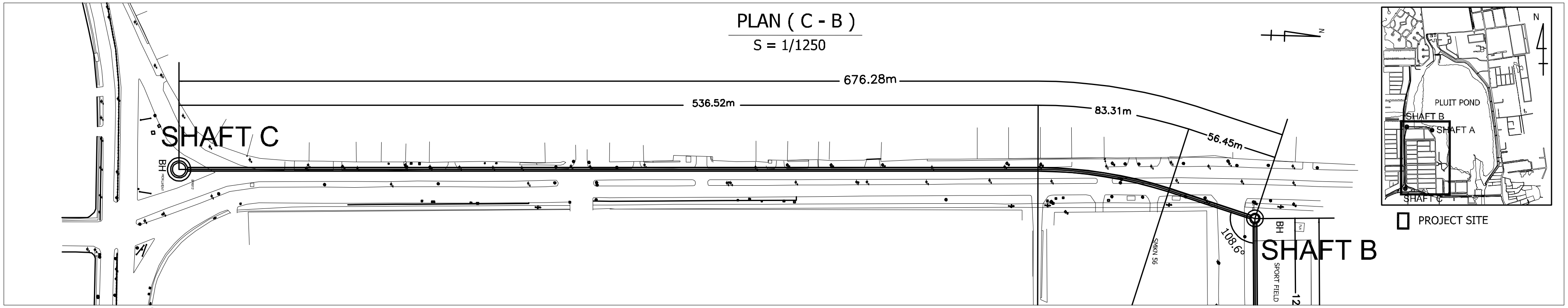
SHAFT A	SHAFT B	SHAFT C
A = 1,500 m ^{2}	A = 700 m ^{2}	A = 1,450 m ^{2}
		

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	PROPOSED CONSTRUCTION YARD FOR SHAFT (A, B & C)
DRAWING NO:	G - 01-2
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY
DESIGNED BY:	SHIMAO HIDAKA — DATE:
CHECKED BY:	HARUTOSHI UCHIDA — DATE:

Japan International Cooperation Agency

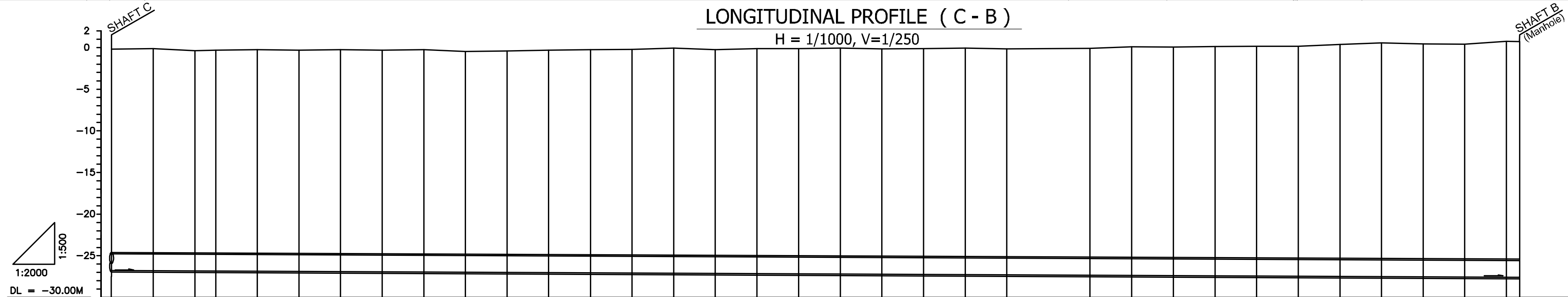
PLAN (C - B)

S = 1/1250



LONGITUDINAL PROFILE (C - B)

H = 1/1000, V=1/250

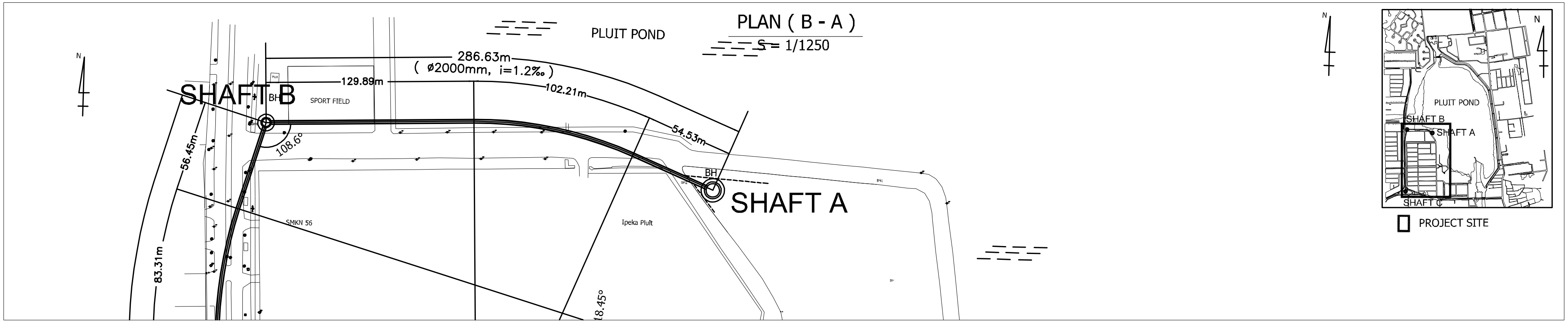


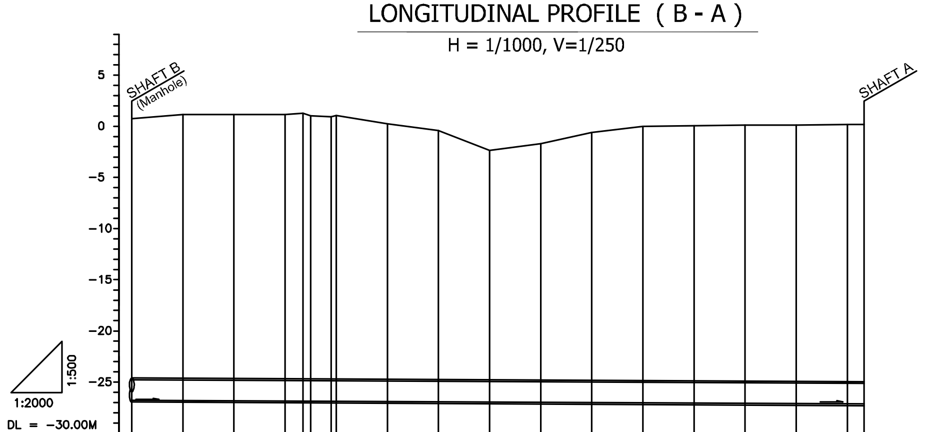
Diameter (m)	⌀2.00
Gradient (‰)	1.2
Length (m)	676.28

Total Length (m)	Ground Elevation (m)	Earth Covering (m)	Invert Elevation (m)
0.00	−0.181	24.18	−26.538
20.00	−0.131		
40.00	−0.362		
50.00	−0.318	24.11	−26.598
70.00	−0.254		
90.00	−0.305		
110.00	−0.239	24.26	−26.670
130.00	−0.316		
150.00	−0.269	24.27	−26.718
170.00	−0.476		
190.00	−0.406		
210.00	−0.319	24.30	−26.790
230.00	−0.258		
250.00	−0.225	24.44	−26.838
270.00	−0.071		
290.00	−0.235		
310.00	−0.131	24.60	−26.910
330.00	−0.125		
350.00	−0.066	24.72	−26.958
370.00	−0.154		
390.00	−0.127		
410.00	−0.052	24.80	−27.030
430.00	−0.154		
470.00	−0.100		
490.00	0.070	25.02	−27.126
510.00	0.059		
530.00	0.118		
550.00	0.143	25.17	−27.198
570.00	0.153		
590.00	0.368		
610.00	0.560	25.70	−27.318
630.00	0.444		
650.00	0.410	25.55	−27.318
670.00	0.762	25.91	−27.349
676.28	0.734	25.96	−27.399

PROJECT :	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE :	PLAN AND LONGITUDINAL PROFILE (C - B)
DRAWING NO :	G - 02
CONSULTANTS :	NIHON SUIDO CONSULTANTS, NIPPON KOEI, CITY OF KITAKYUSHU, ORIENTAL CONSULTANTS, WATER AGENCY
DESIGNED BY :	SHIMAO HIDAKA — DATE :
CHECKED BY :	HARUTOSHI UCHIDA — DATE :

Japan International Cooperation Agency



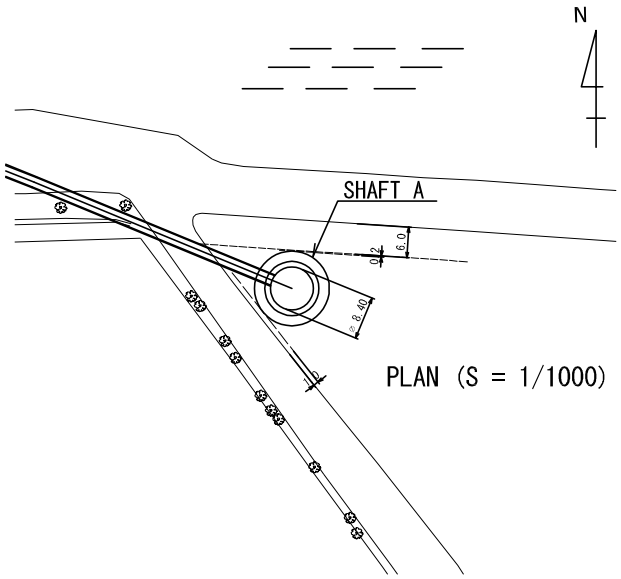


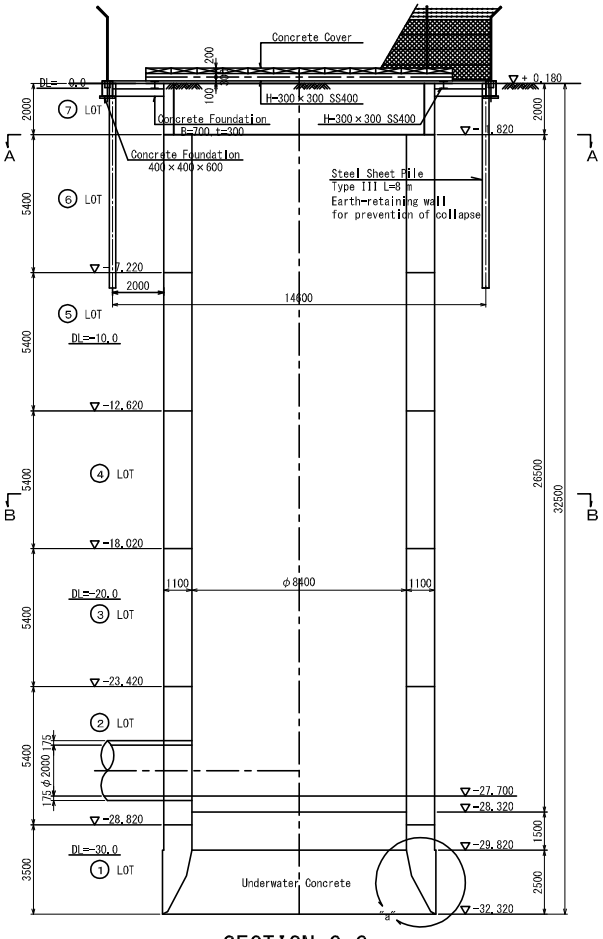
Diameter (m)	ø 2.00																		
Gradient (‰)	1.2																		
Length (m)	286.80																		
Ground Elevation (m)	0.734	1.160	1.160	1.160	1.281	1.026	0.933	1.059	0.250	−0.400	−2.348	−1.700	−0.606	−0.035	0.041	0.123	0.126	0.178	0.181
Earth Covering (m)	25.91 25.96			26.46					25.59			23.72		25.43		25.64		25.74	25.75
Invert Elevation (m)	−27.349 −27.399			−27.471					−27.519			−27.591		−27.639		−27.687		−27.735	−27.743
Total Length (m)	0.00	20.00	40.00	60.00	67.00	70.00	78.00	80.00	100.00	120.00	140.00	160.00	180.00	200.00	220.00	240.00	260.00	280.00	286.63

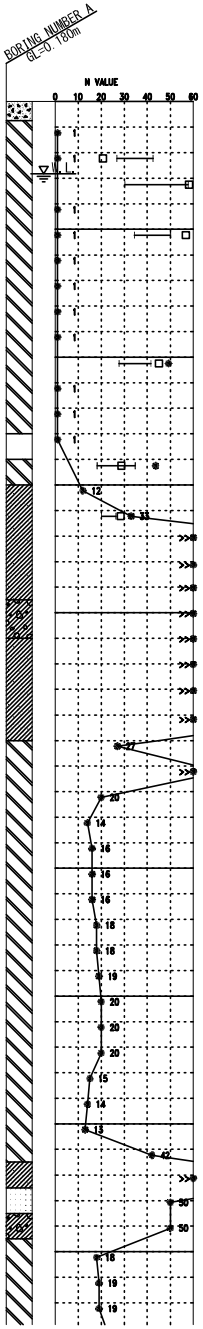
PROJECT :	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE :	PLAN AND LONGITUDINAL PROFILE (B - A)
DRAWING NO :	G - 03
CONSULTANTS :	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY
DESIGNED BY :	SHIMAO HIDAKA — DATE :
CHECKED BY :	HARUTOSHI UCHIDA — DATE :

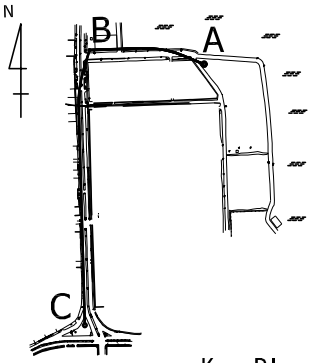
Japan International Cooperation Agency

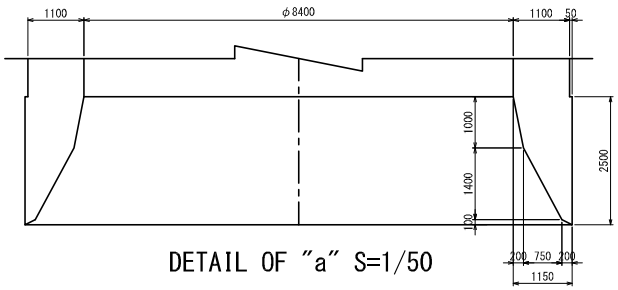
DEPARTURE SHAFT A S=1/50, 1/100, 1/1000

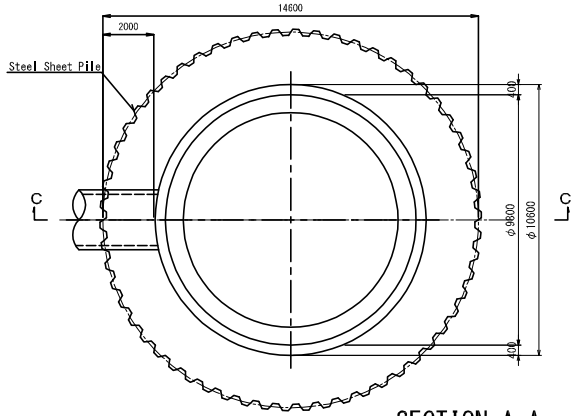


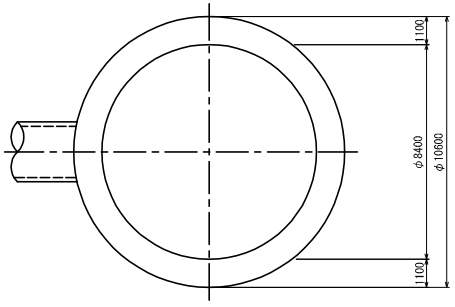








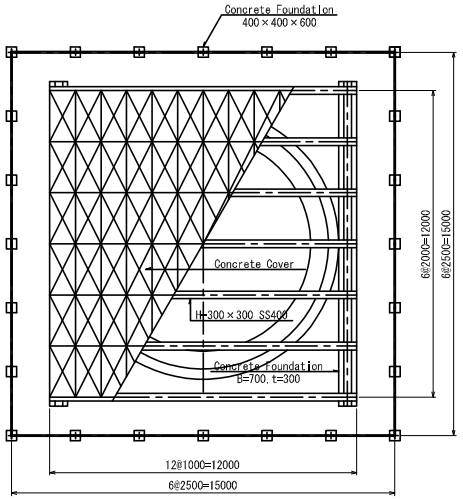




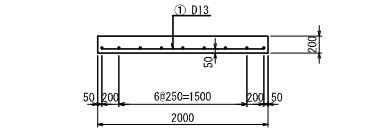
PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	DEPARTURE SHAFT A
DRAWING NO:	G - 04
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY
DESIGNED BY: SHIMAO HIDAKA	DATE:
CHECKED BY: HARUTOSHI UCHIDA	DATE:

Japan International Cooperation Agency

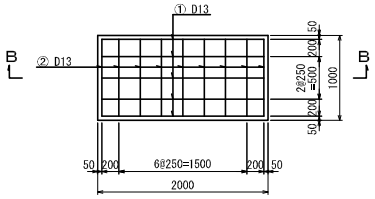
DETAIL OF PROTECTION SHAFT A S=1/30, 1/100



PLAN S=1/100

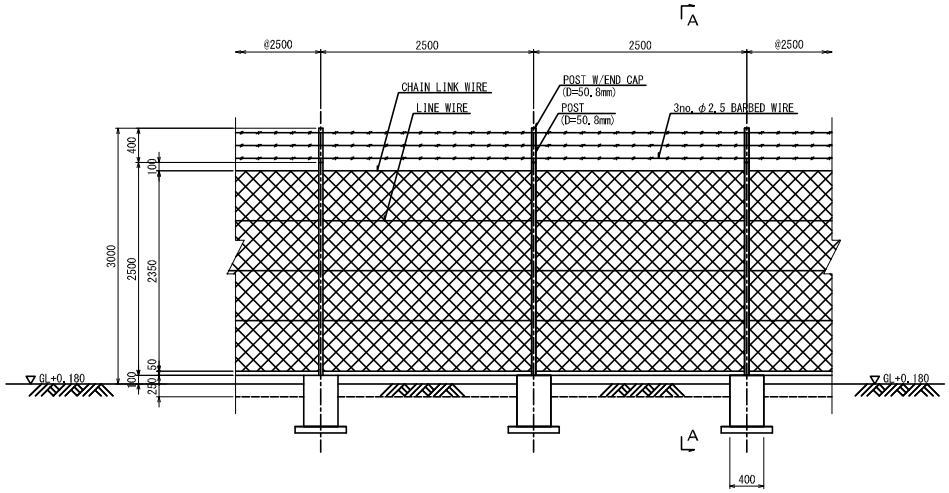


SECTION B-B

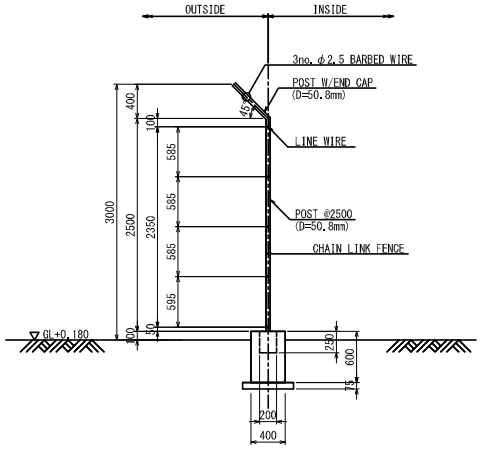


PLAN

RE-BAR ARRANGEMENT OF CONCRETE COVER S=1/30



ELEVATION OF FENCE S=1/30

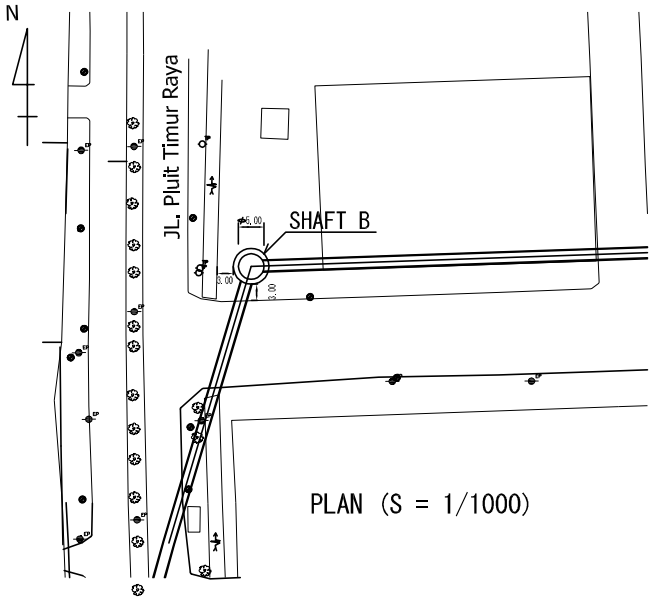


SECTION A-A S=1/30

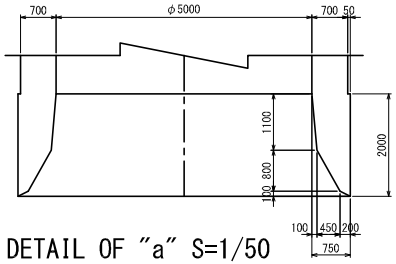
PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	DETAIL OF PROTECTION SHAFT A		
DRAWING NO:	G - 05		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

Japan International Cooperation Agency

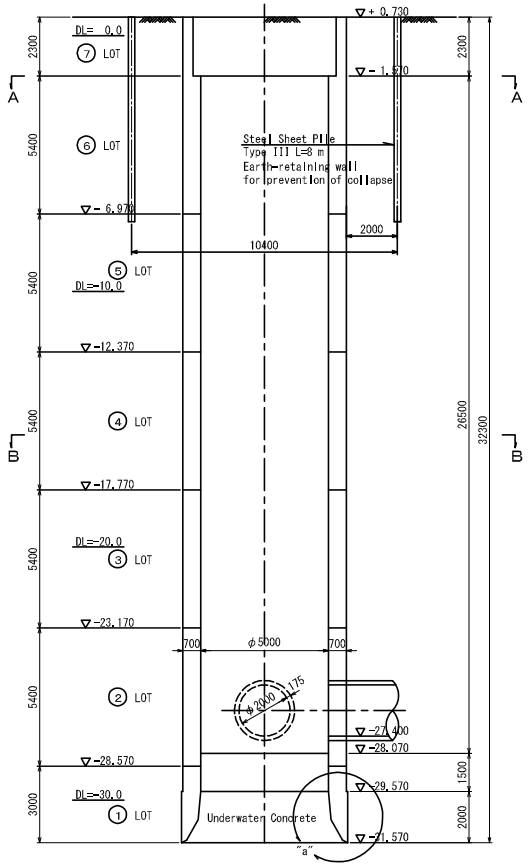
ARRIVAL SHAFT B S=1/50, 1/100, 1/1000



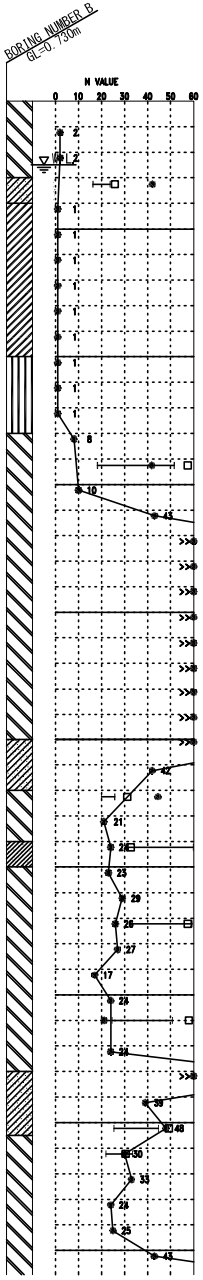
PLAN (S = 1/1000)

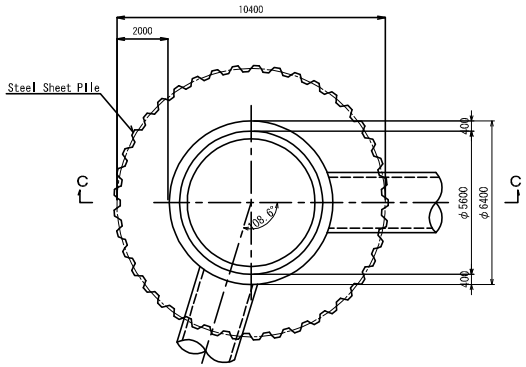


DETAIL OF "a" S=1/50

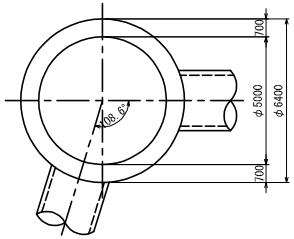


SECTION C-C

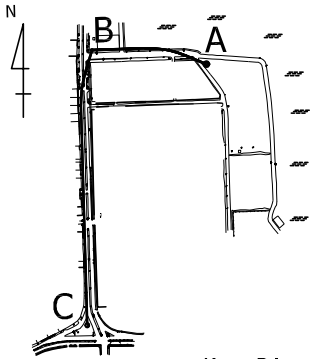




SECTION A-A



SECTION B-B

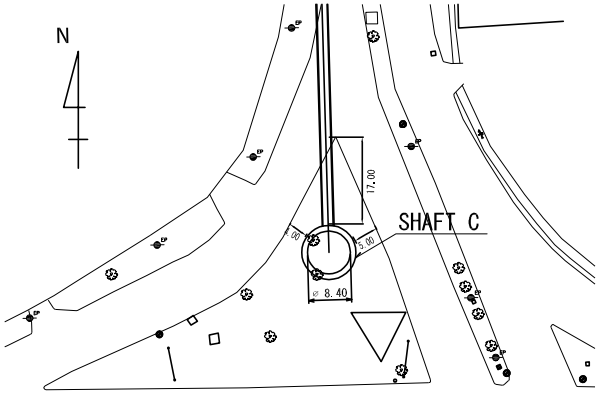


Key Plan

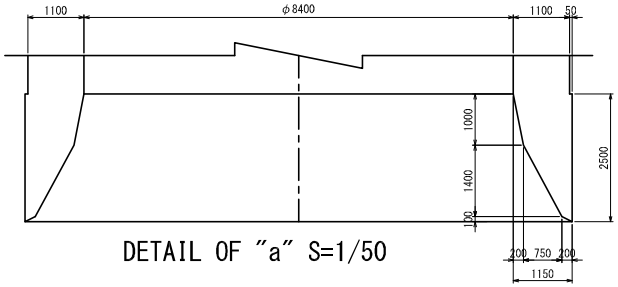
PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	ARRIVAL SHAFT B
DRAWING NO:	G-06
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY
DESIGNED BY: SHIMAO HIDAKA	DATE:
CHECKED BY: HARUTOSHI UCHIDA	DATE:

Japan International Cooperation Agency

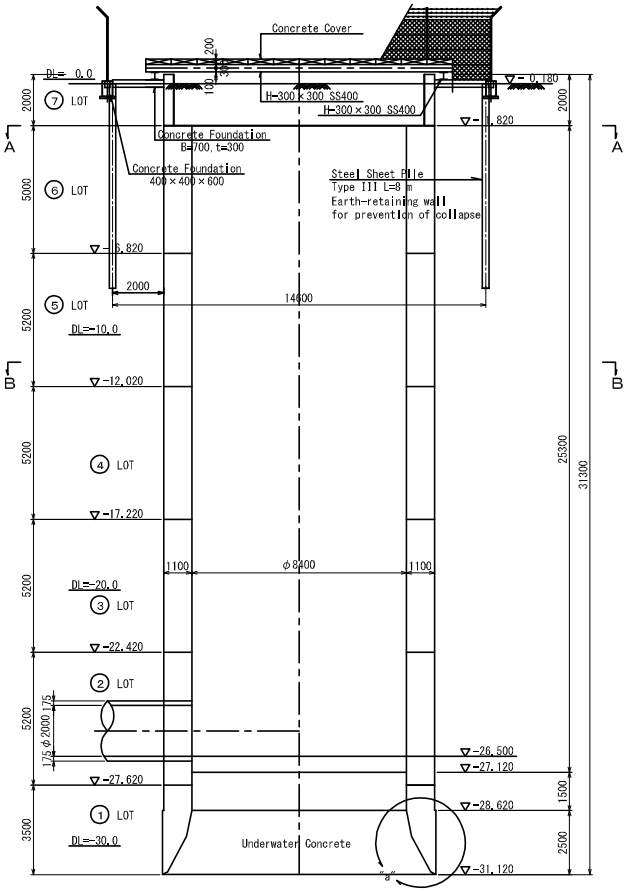
DEPARTURE SHAFT C S=1/50, 1/100, 1/1000



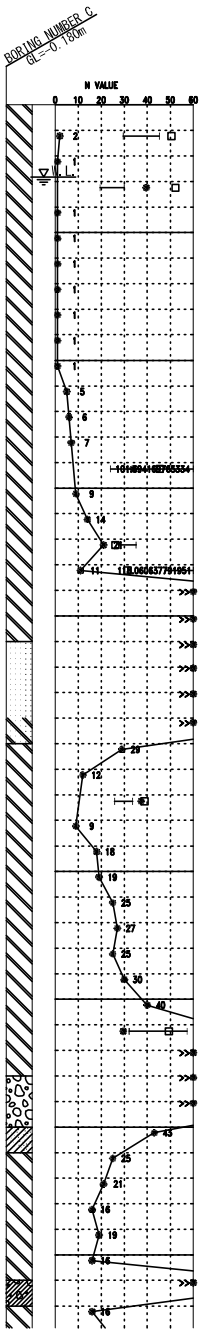
PLAN (S = 1/1000)

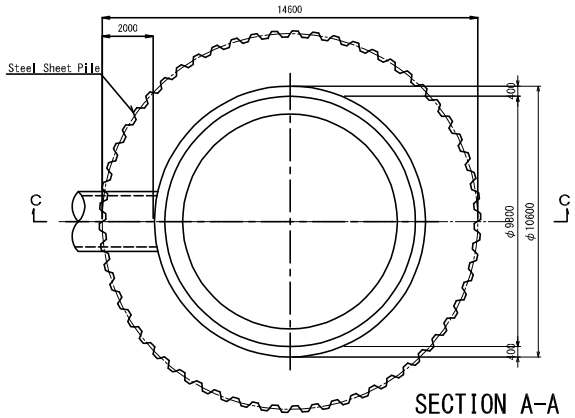


DETAIL OF "a" S=1/50

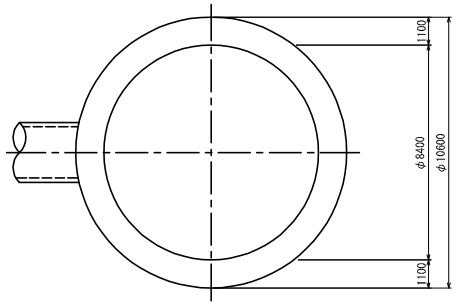


SECTION C-C

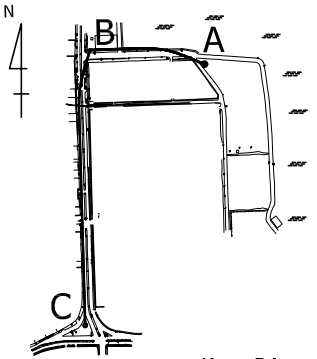




SECTION A-A



SECTION B-B

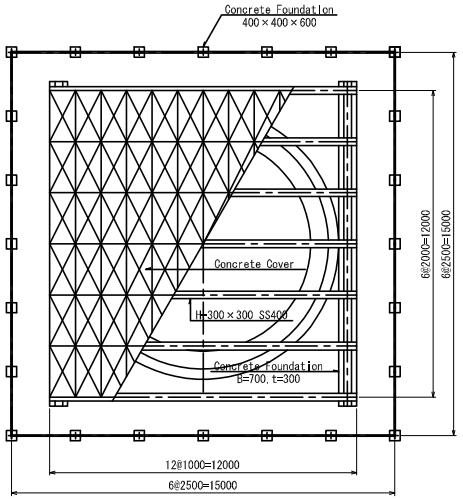


Key Plan

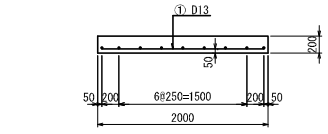
PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	DEPARTURE SHAFT C
DRAWING NO:	G-07
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY
DESIGNED BY: SHIMAO HIDAKA	DATE:
CHECKED BY: HARUTOSHI UCHIDA	DATE:

Japan International Cooperation Agency

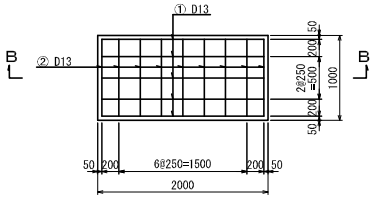
DETAIL OF PROTECTION SHAFT C S=1/30, 1/100



PLAN S=1/100

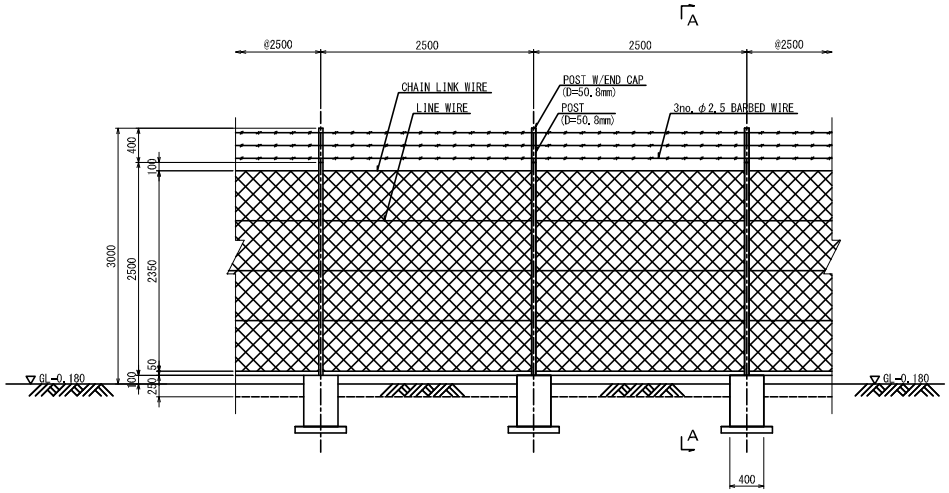


SECTION B-B

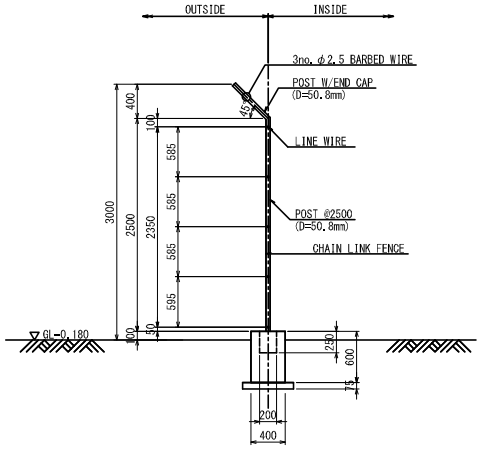


PLAN

RE-BAR ARRANGEMENT OF CONCRETE COVER S=1/30



ELEVATION OF FENCE S=1/30

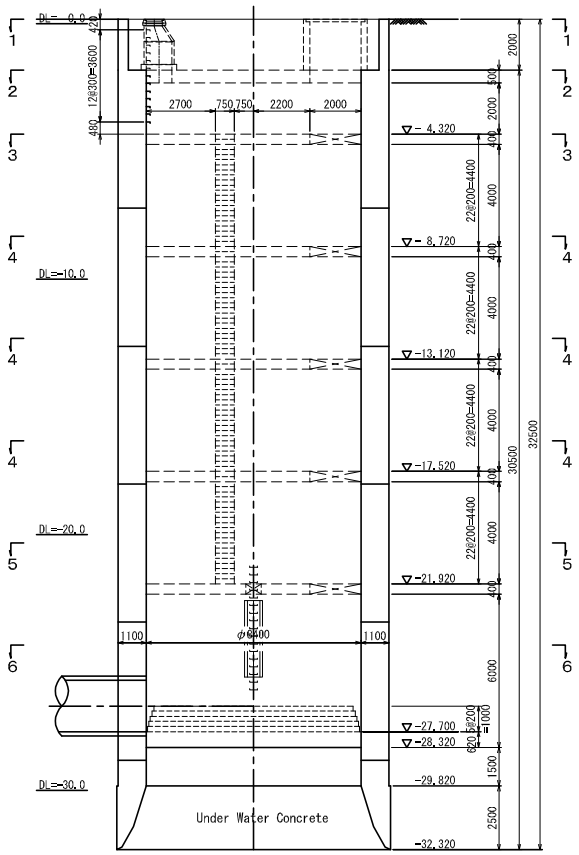


SECTION A-A S=1/30

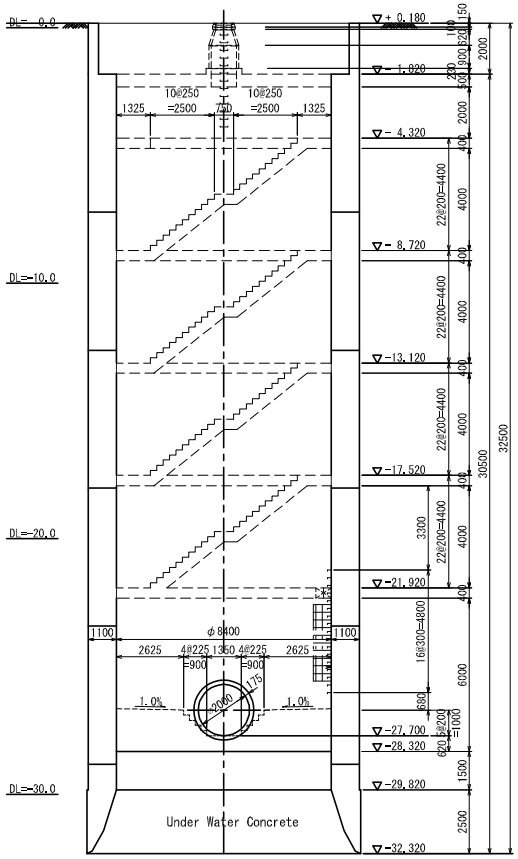
PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	DETAIL OF PROTECTION SHAFT C		
DRAWING NO:	G - 08		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

Japan International Cooperation Agency

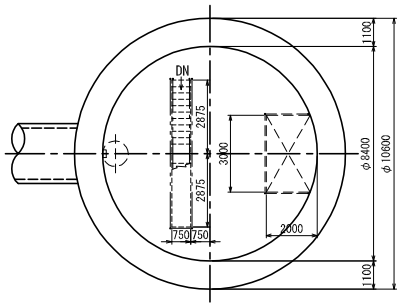
STRUCTURAL DRAWING OF SHAFT A S=1/100



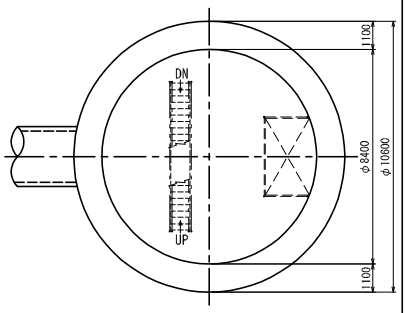
SECTION A-A



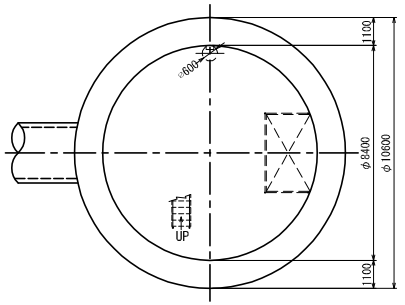
SECTION B-B



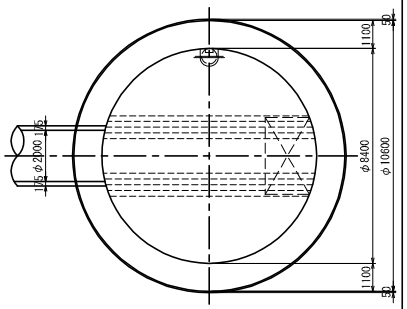
SECTION 3-3



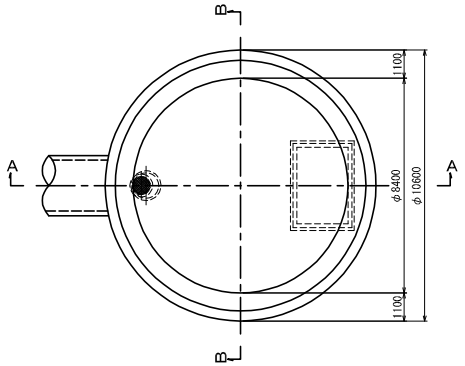
SECTION 4-4



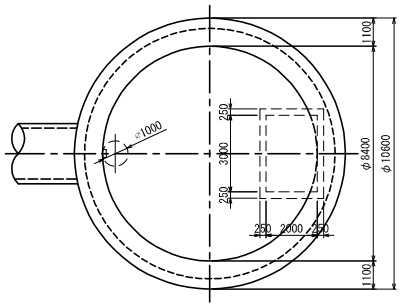
SECTION 5-5



SECTION 6-6



SECTION 1-1



SECTION 2-2

NOTE:

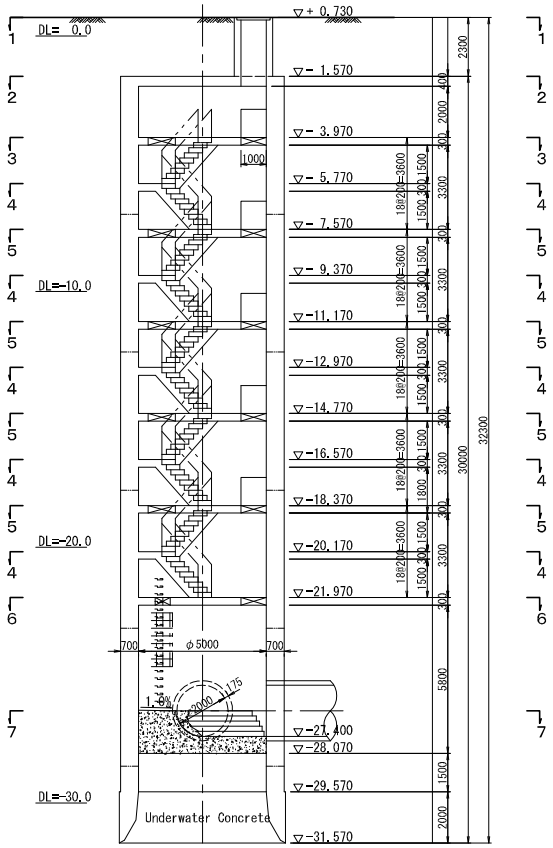
-------- SHOWS FUTURE CONSTRUCTIONS.

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	STRUCTURAL DRAWING OF SHAFT A
DRAWING NO:	G - 09
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY

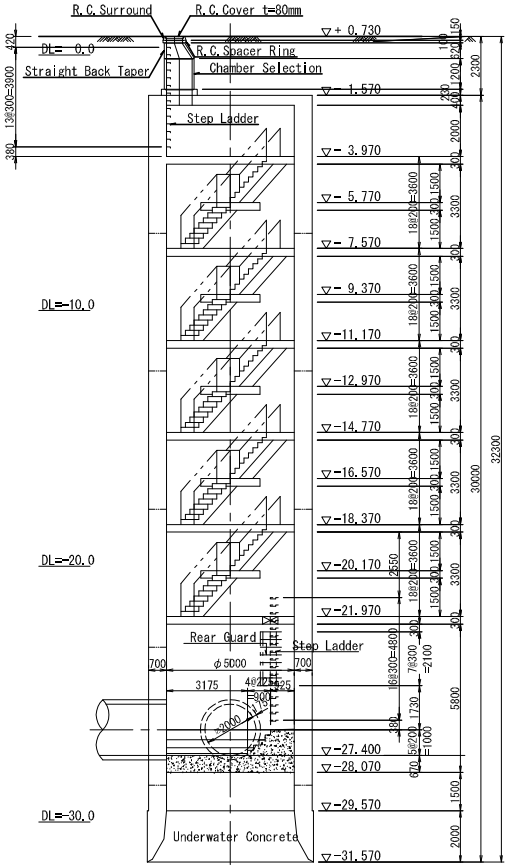
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

Japan International Cooperation Agency

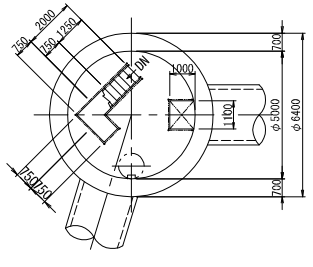
STRUCTURAL DRAWING OF SHAFT B S=1/100



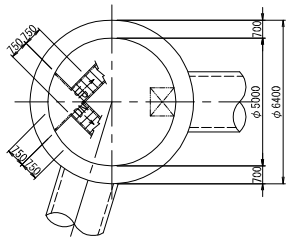
SECTION A-A



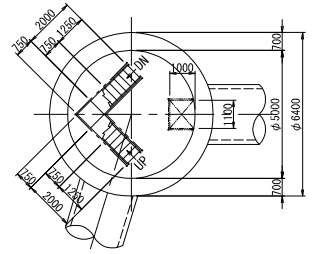
SECTION B-B



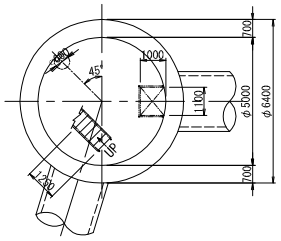
SECTION 3-3



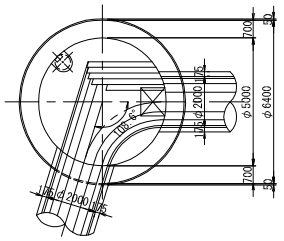
SECTION 4-4



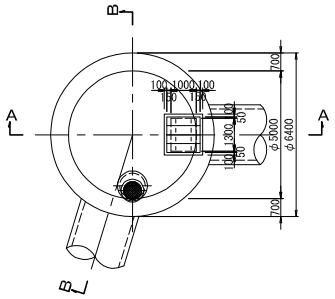
SECTION 5-5



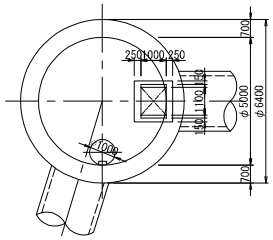
SECTION 6-6



SECTION 7-7



SECTION 1-1

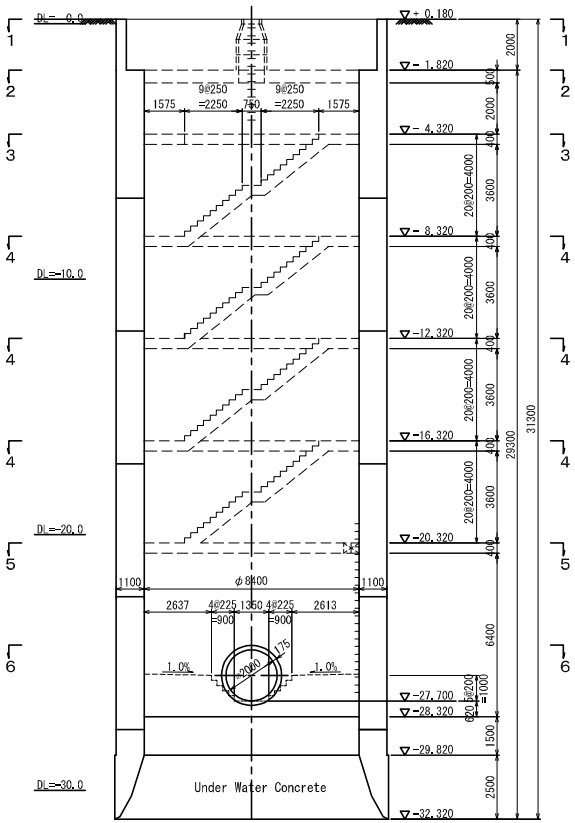


SECTION 2-2

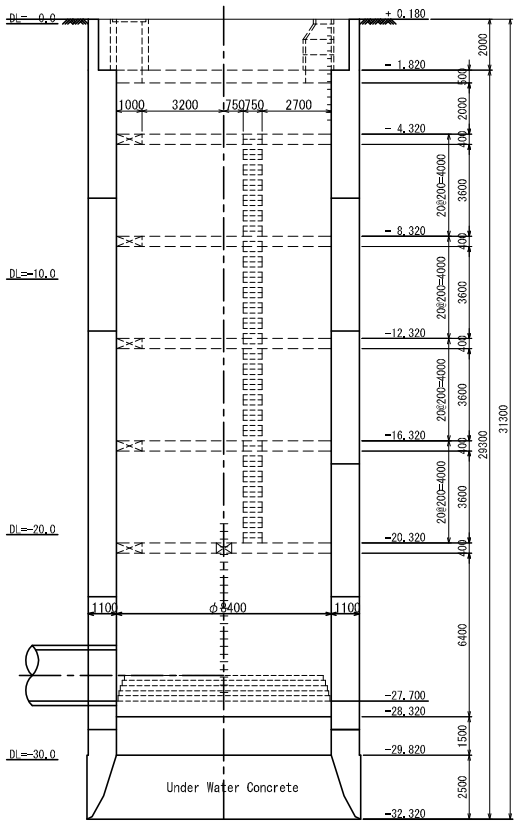
PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	STRUCTURAL DRAWING OF SHAFT B
DRAWING NO:	G - 10
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY
DESIGNED BY:	SHIMAO HIDAKA — DATE:
CHECKED BY:	HARUTOSHI UCHIDA — DATE:

Japan International Cooperation Agency

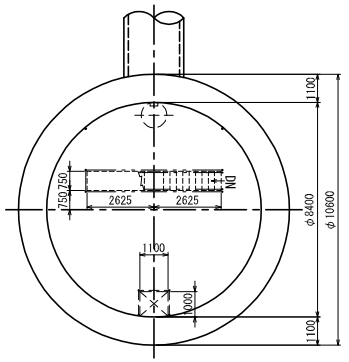
STRUCTURAL DRAWING OF SHAFT C （1） S=1/100



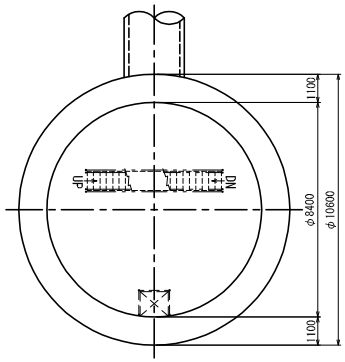
SECTION A-A



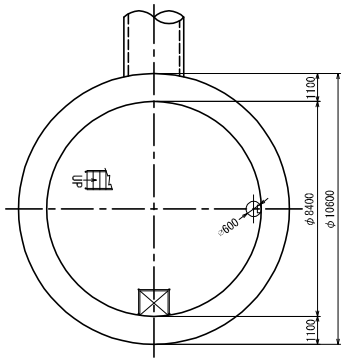
SECTION B-B



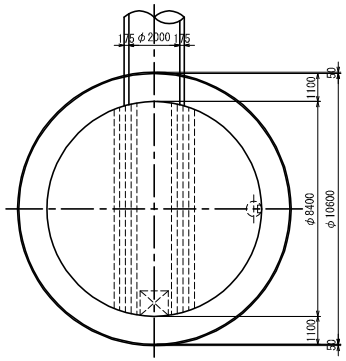
SECTION 3-3



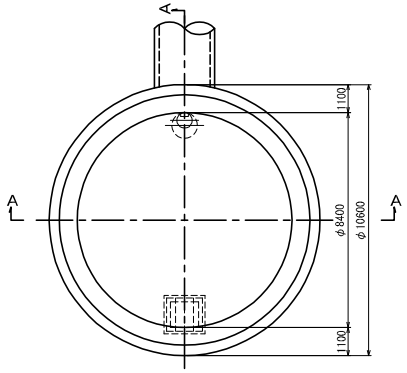
SECTION 4-4



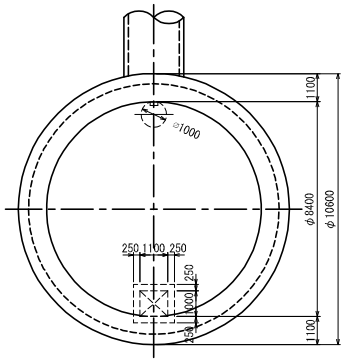
SECTION 5-5



SECTION 6-6



SECTION 1-1



SECTION 2-2

NOTE:

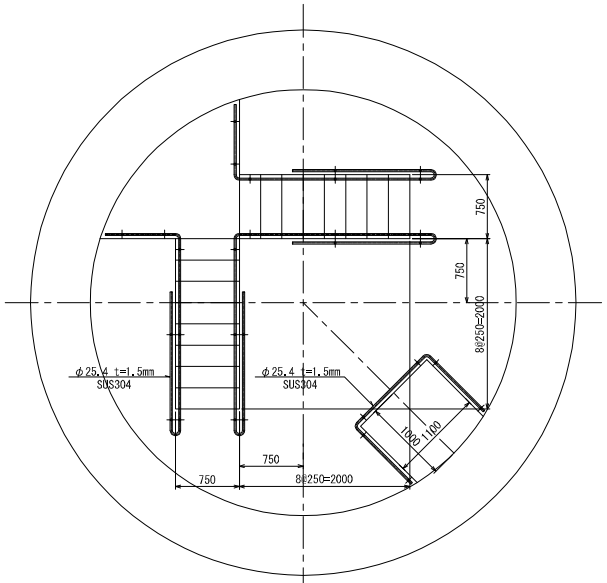
-------- SHOWS FUTURE CONSTRUCTIONS.

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	STRUCTURAL DRAWING OF SHAFT C
DRAWING NO:	G - 11
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY

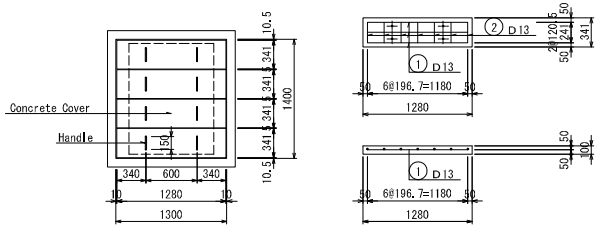
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

Japan International Cooperation Agency

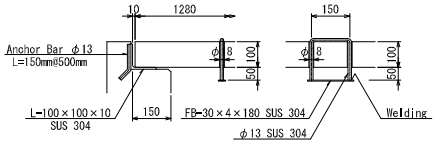
DETAIL DRAWING OF SUBSIDIARY S=1/10, 1/30



S=1/30

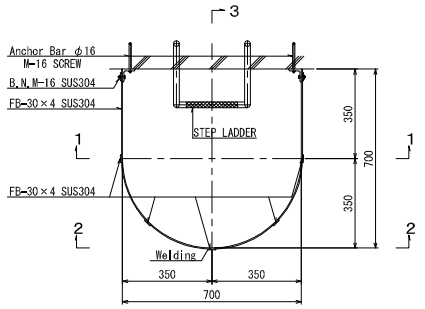


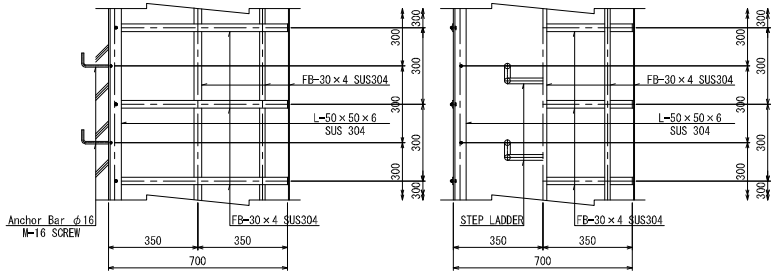
S=1/30 S=1/30



S=1/10

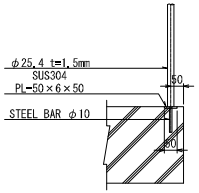
DETAIL OF CONCRETE COVER



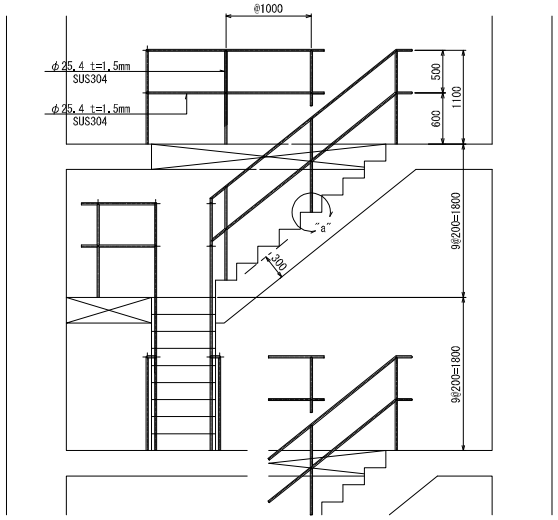


3－3 1－1 2－2

DETAIL OF REAR GUARD S=1/10



DETAIL OF "a" S=1/10



S=1/30

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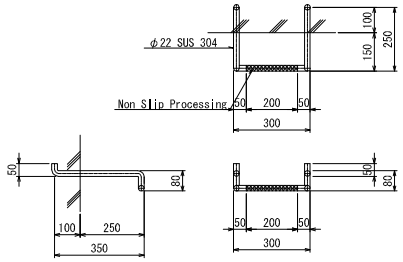


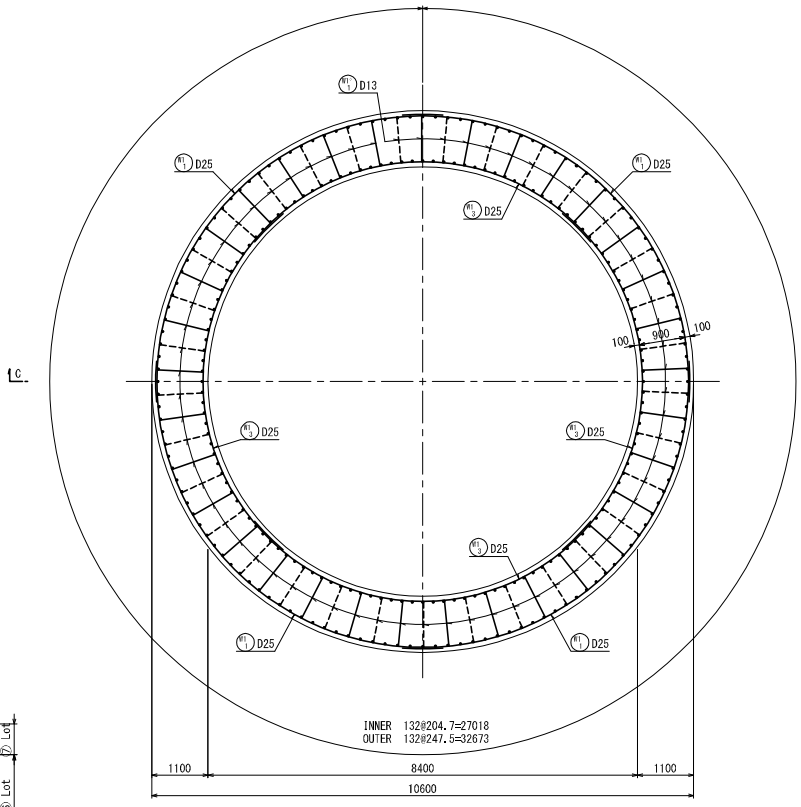
DETAIL OF STEP LADDER S=1/10

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	DETAIL DRAWING OF SUBSIDIARY		
DRAWING NO:	G - 12		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

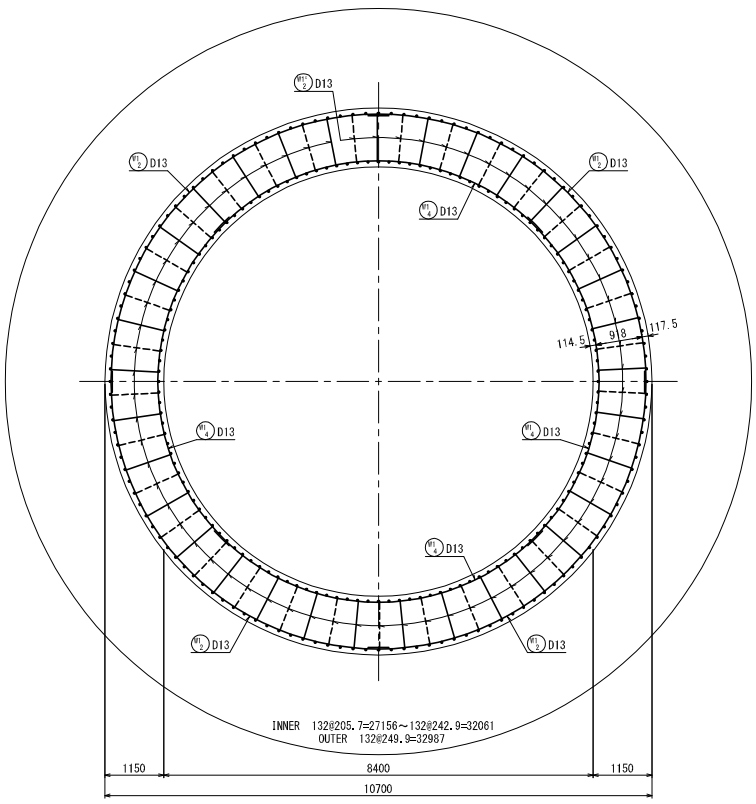
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT A （1） S=1/50

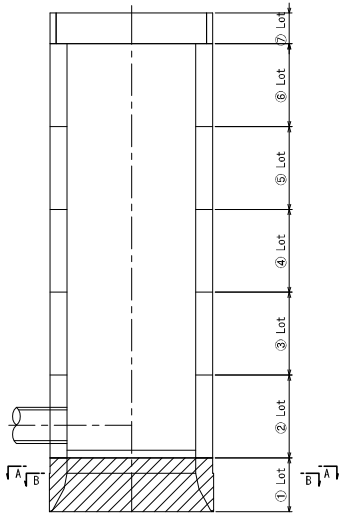
(1ST STEP)



A - A



B - B



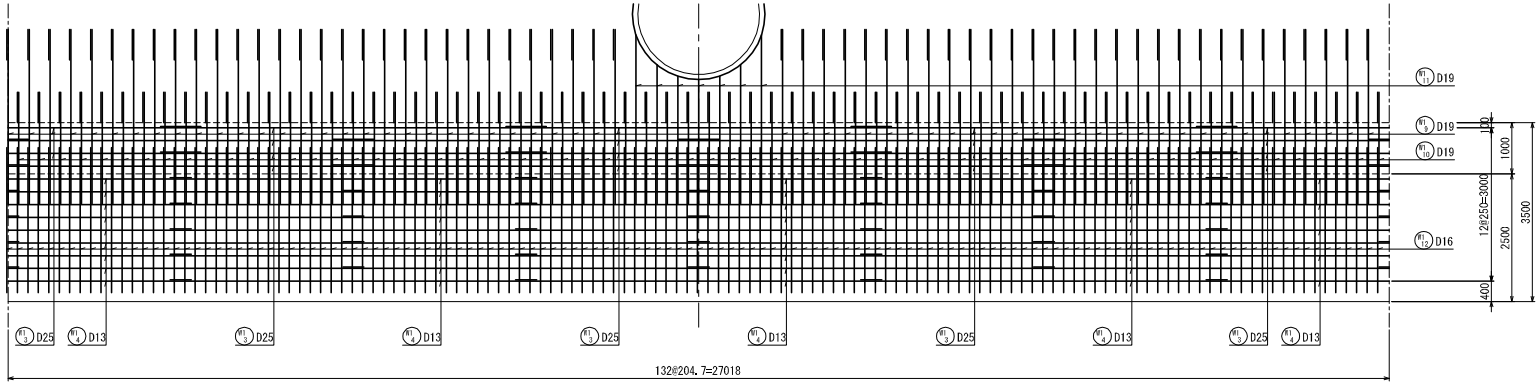
KEY PLAN

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT A (1)		
DRAWING NO:	RA - 01		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

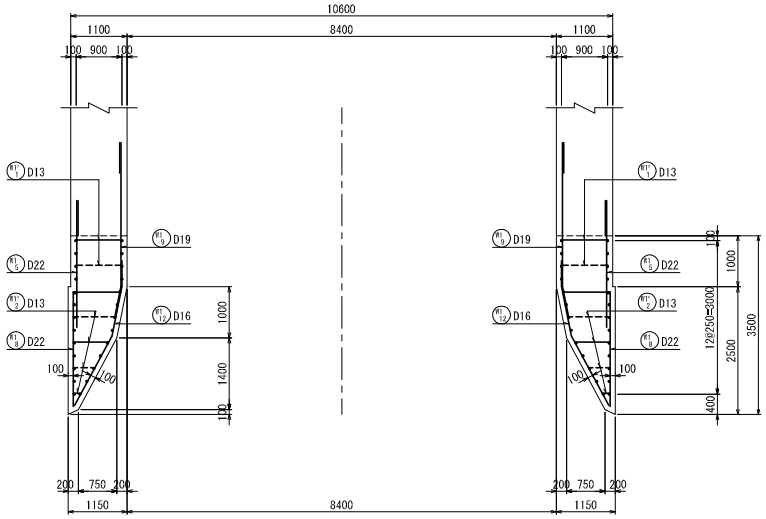
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT A (2) S=1/50

(1ST STEP)



SIDEWALL(INNER)



C - C

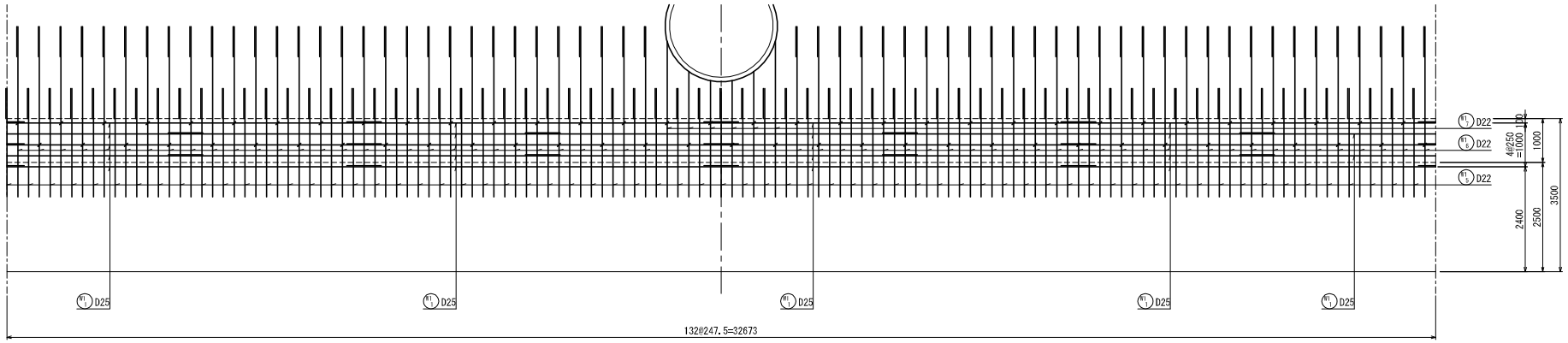
PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT A (2)
DRAWING NO:	RA - 02
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY

DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

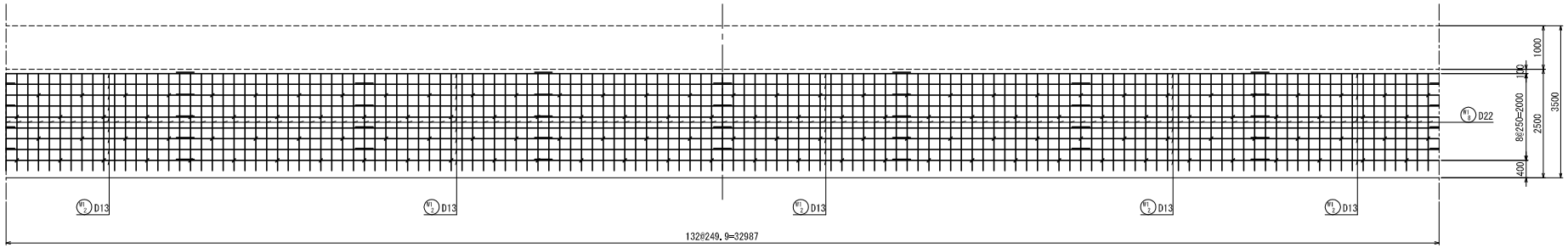
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT A (3) S=1/50

(1ST STEP)



SIDEWALL (OUTER)



TOE OF SHAFT

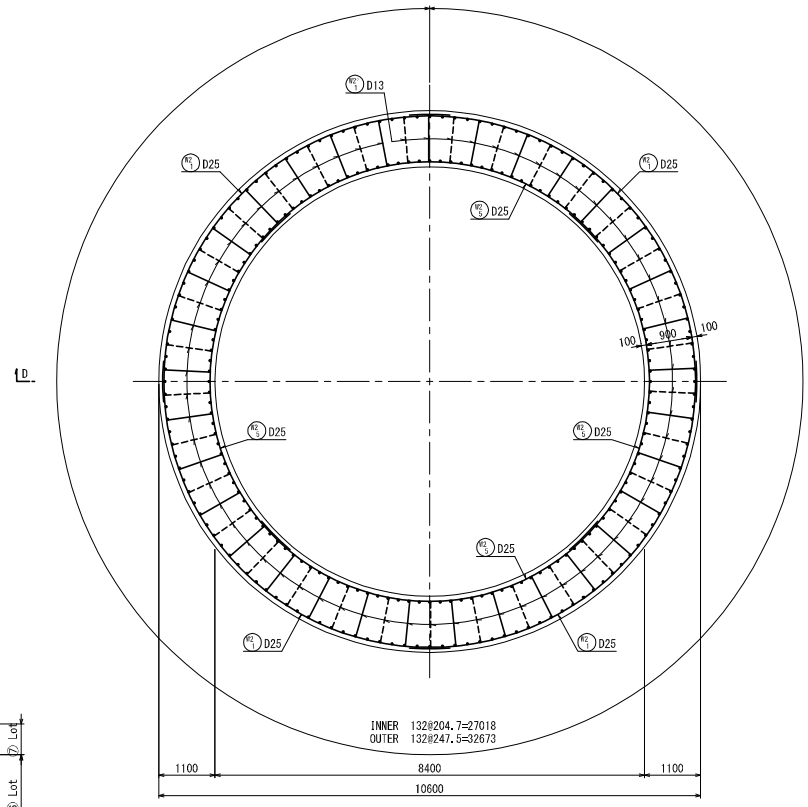
PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT A (3)
DRAWING NO:	RA - 03
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY

DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

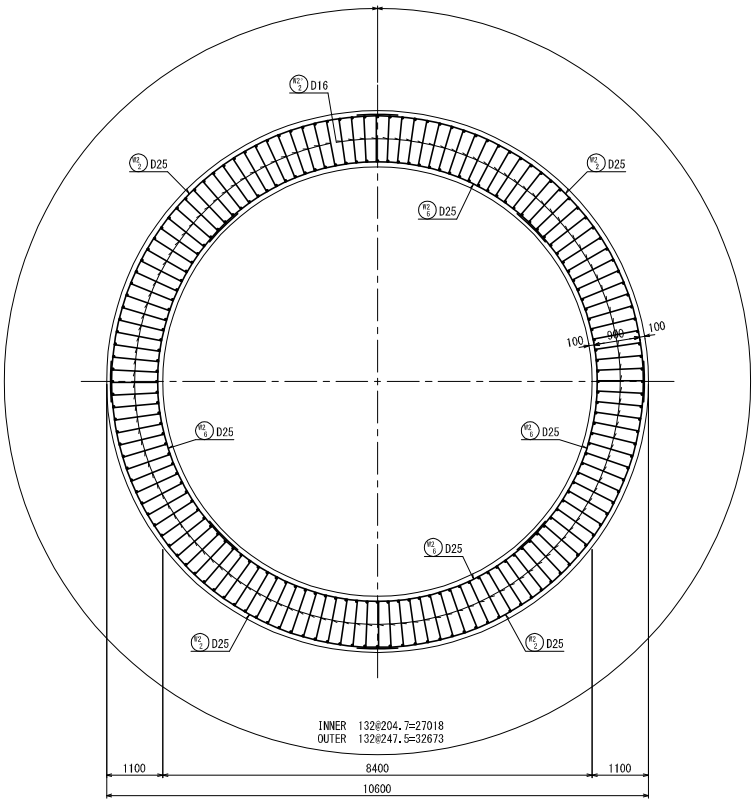
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT A (4) S=1/50

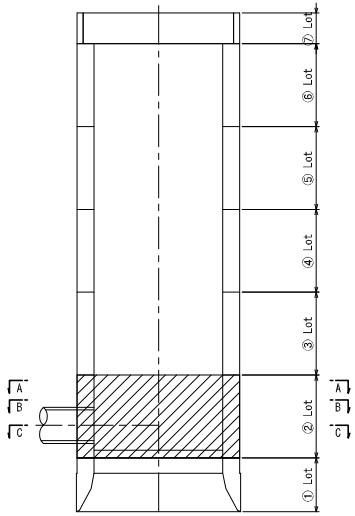
(1ST STEP)



A - A



B - B



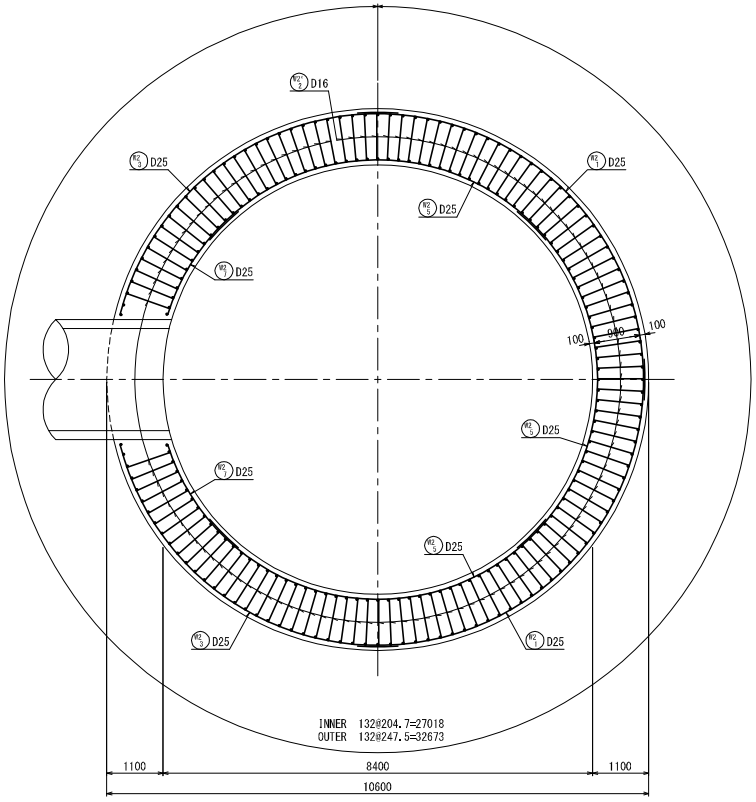
KEY PLAN

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT A (4)		
DRAWING NO:	RA - 04		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

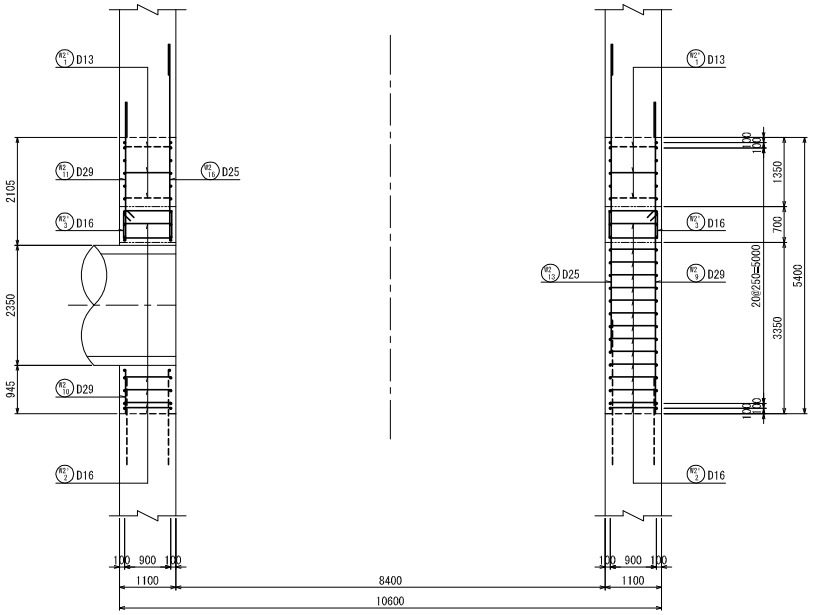
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT A (5) S=1/50

(1ST STEP)



C - C



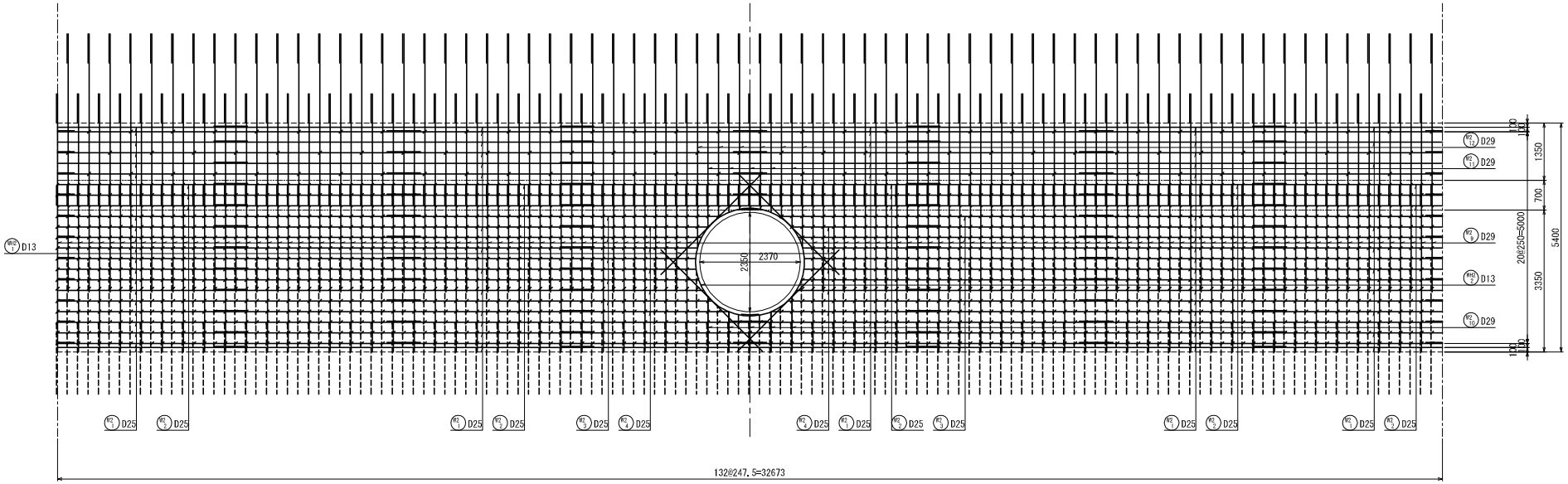
D - D

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT A (5)
DRAWING NO:	RA - 05
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY
DESIGNED BY: SHIMAO HIDAKA	DATE:
CHECKED BY: HARUTOSHI UCHIDA	DATE:

Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT A (6) S=1/50

(1ST STEP)

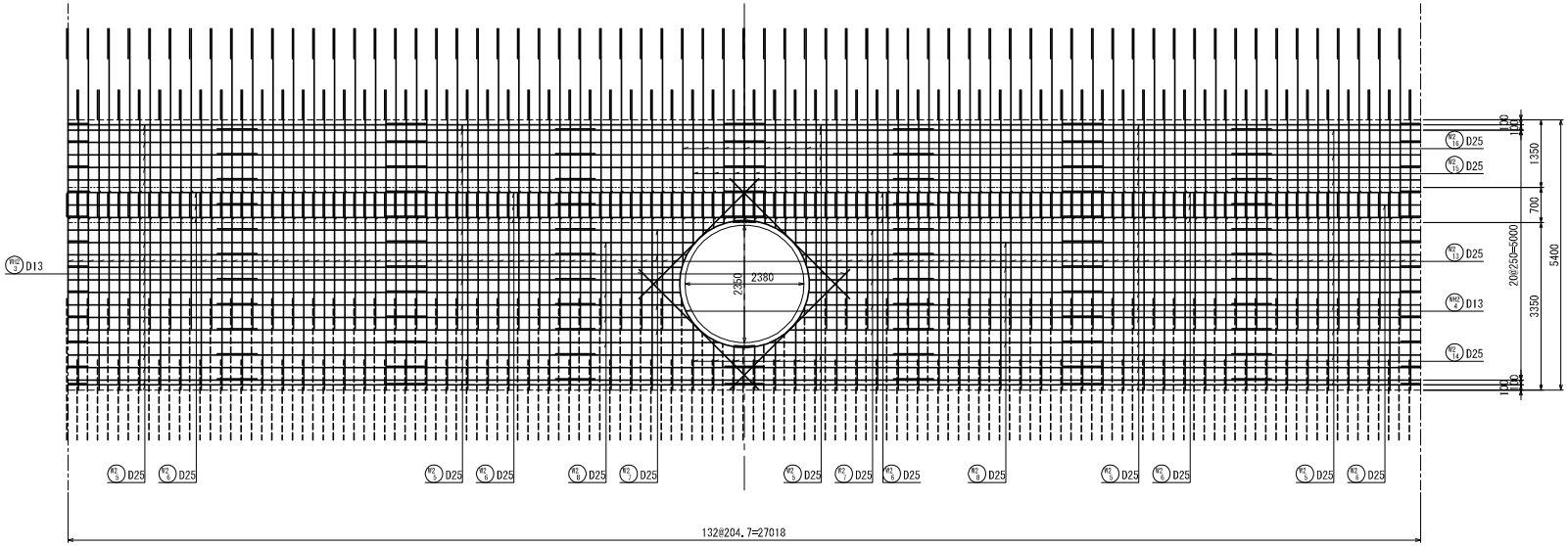


SIDEWALL(OUTER)

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT A (6)		
DRAWING NO:	RA - 06		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	
Japan International Cooperation Agency			

RE-BAR ARRANGEMENT OF SHAFT A (7) S=1/50

(1ST STEP)

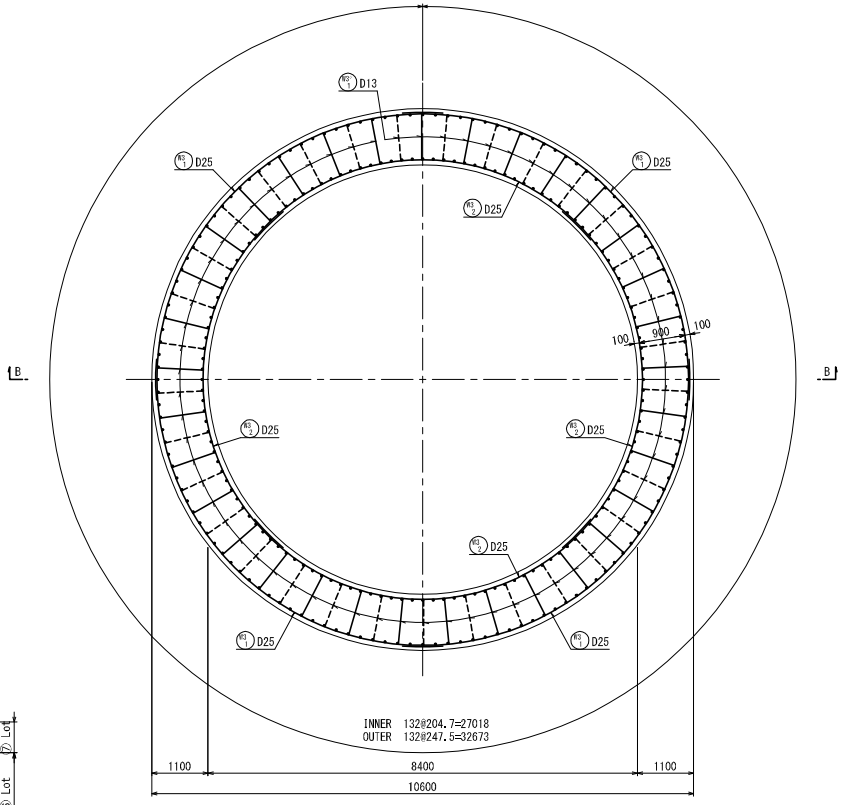


SIDEWALL(INNER)

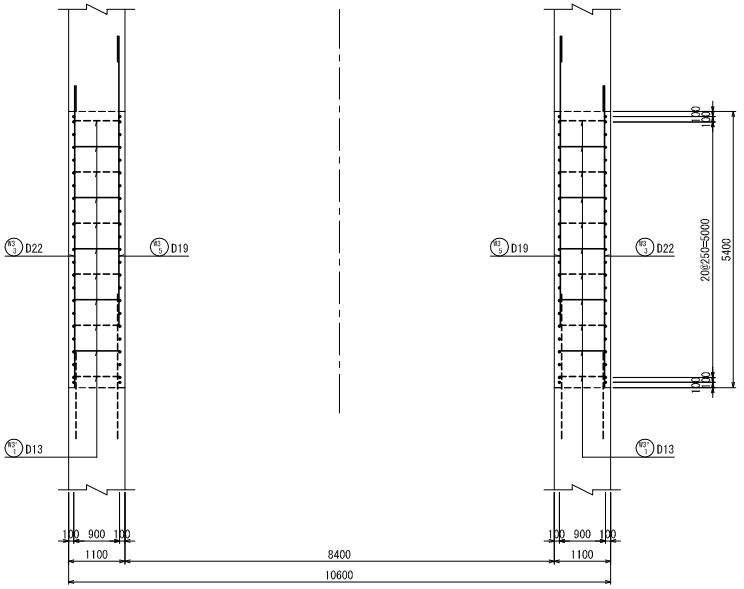
PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT A (7)		
DRAWING NO:	RA - 07		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	
Japan International Cooperation Agency			

RE-BAR ARRANGEMENT OF SHAFT A (8) S=1/50

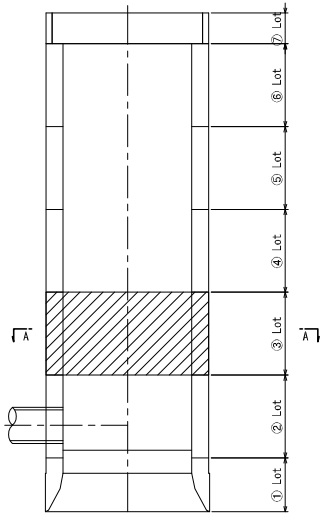
(1ST STEP)



A - A



B - B



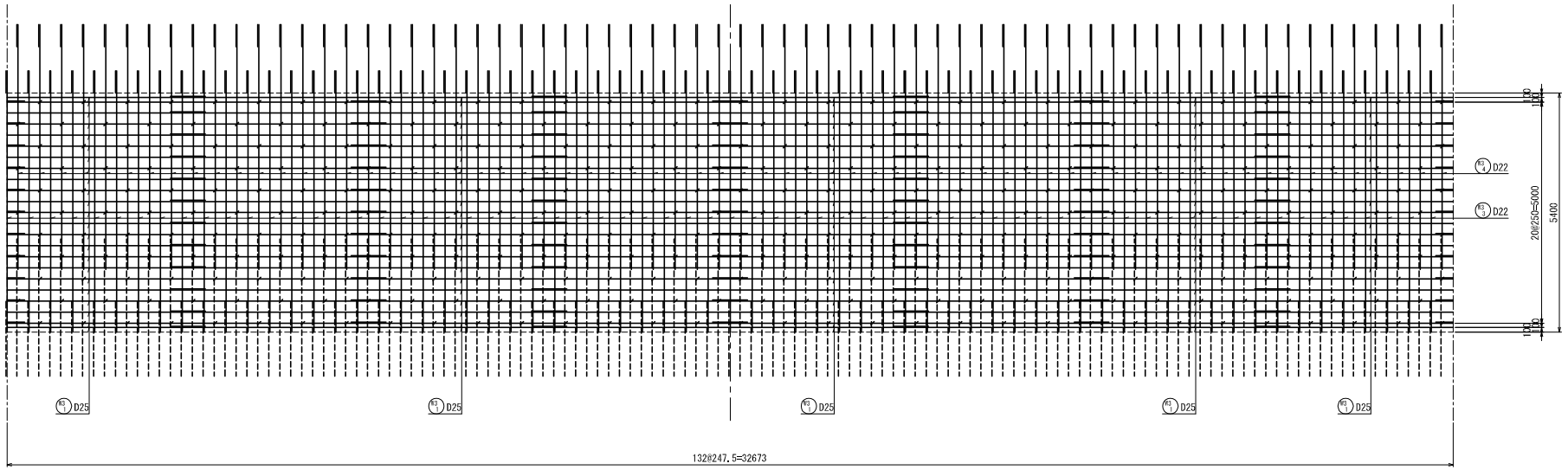
KEY PLAN

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT A (8)		
DRAWING NO:	RA - 08		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT A (9) S=1/50

(1ST STEP)

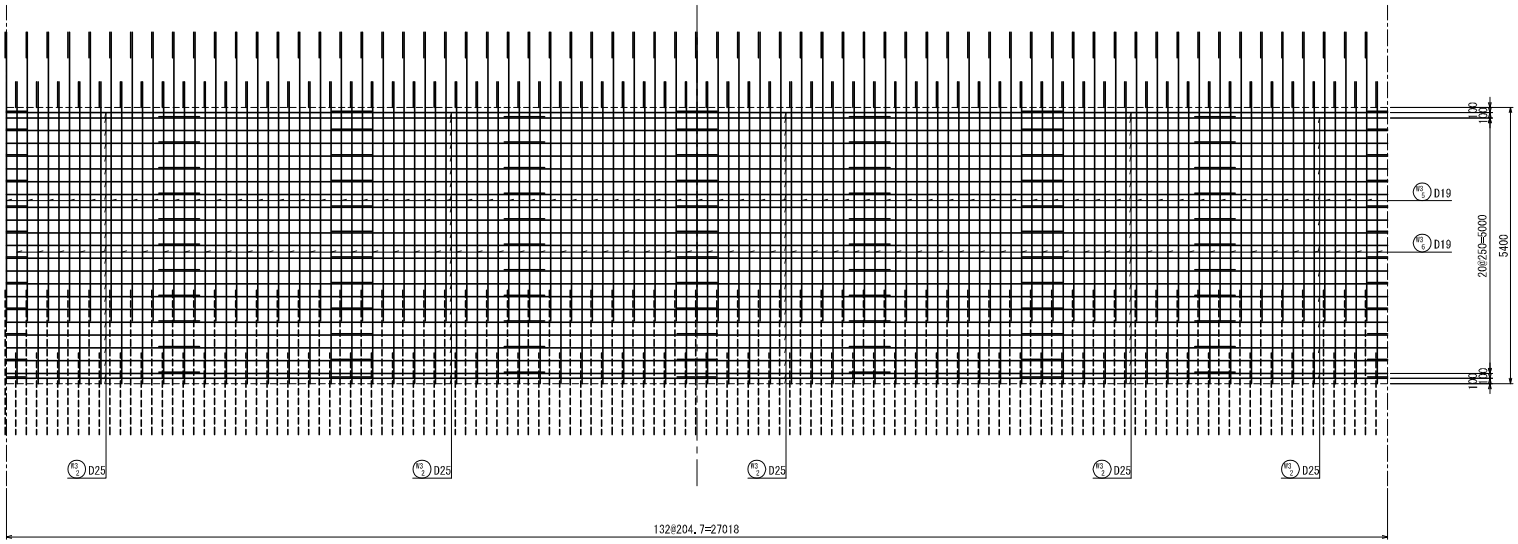


SIDEWALL(OUTER)

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT A (9)		
DRAWING NO:	RA - 09		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	
Japan International Cooperation Agency			

RE-BAR ARRANGEMENT OF SHAFT A (10) S=1/50

(1ST STEP)



SIDEWALL(INNER)

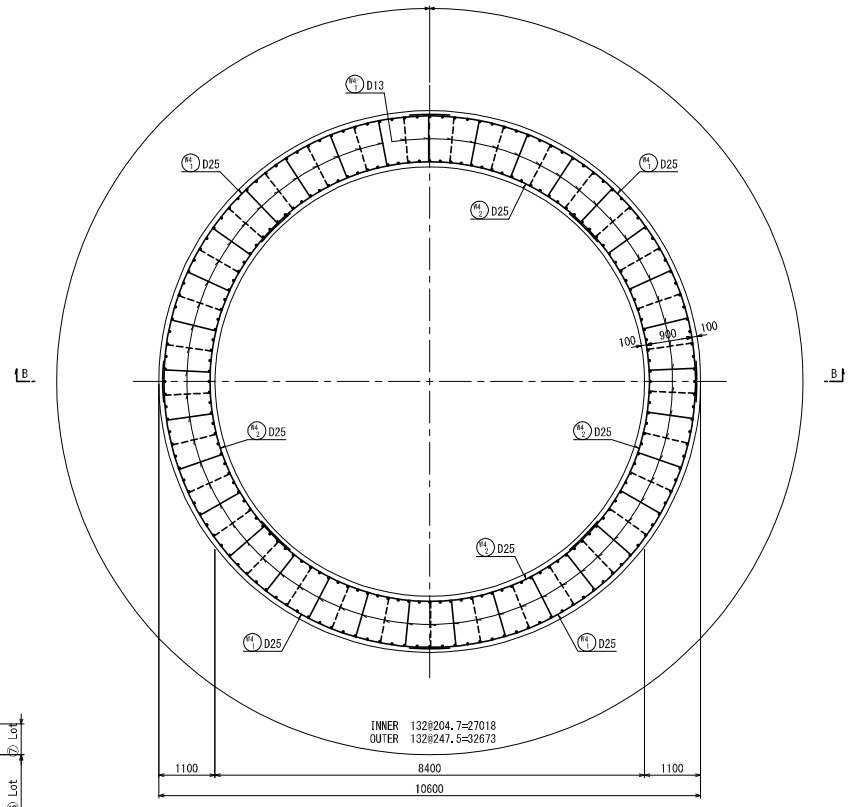
PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT A (10)
DRAWING NO:	RA - 10
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY

DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

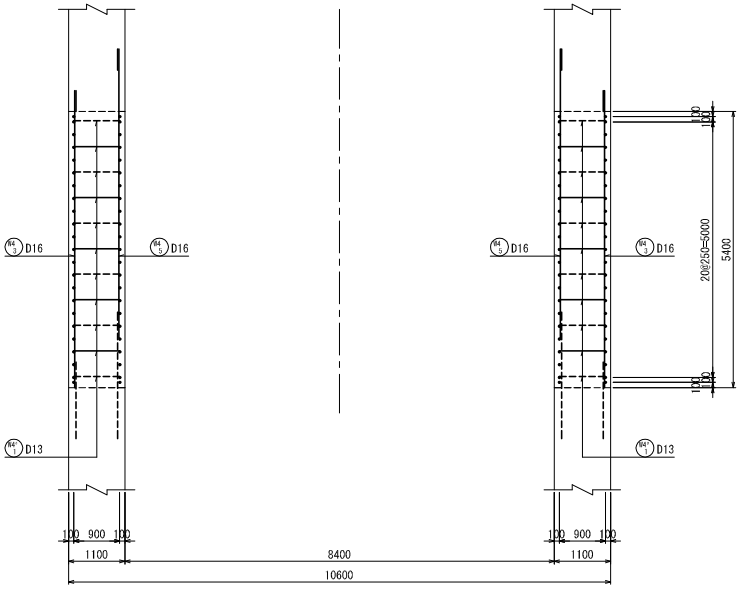
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT A (11) S=1/50

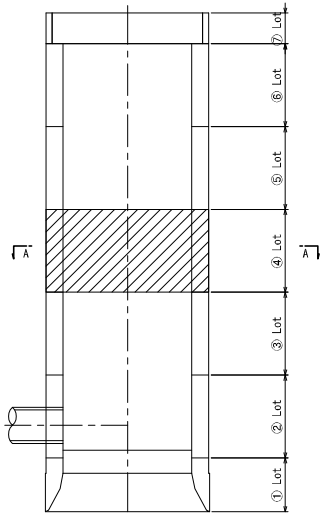
(1ST STEP)



A - A



B - B



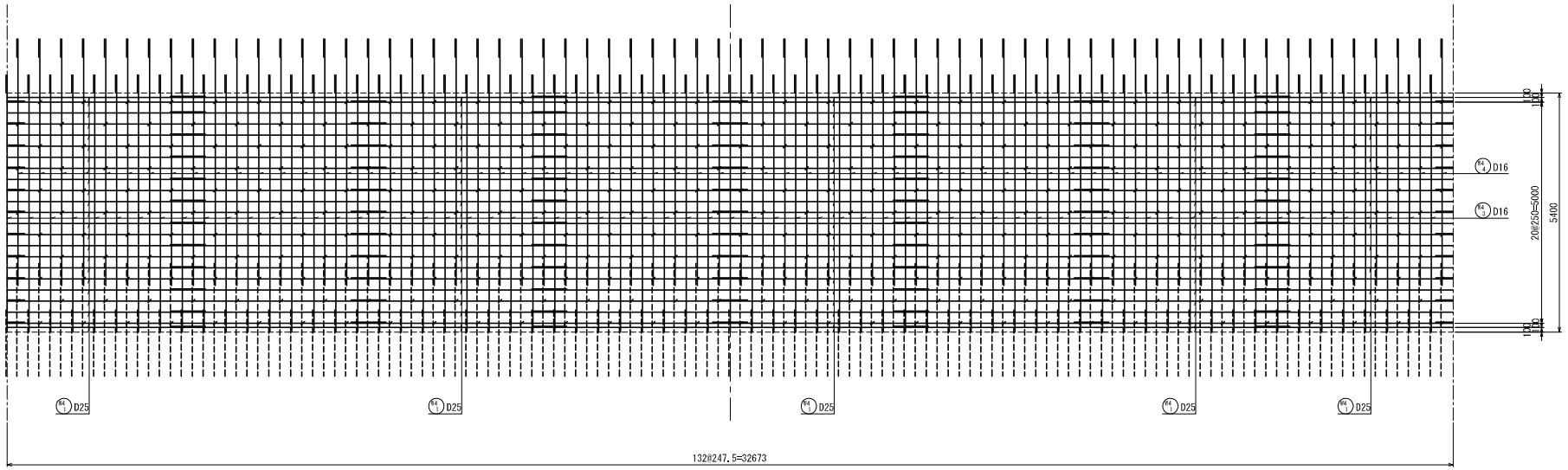
KEY PLAN

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT A (11)		
DRAWING NO:	RA - 11		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT A (12) S=1/50

(1ST STEP)



SIDEWALL(OUTER)

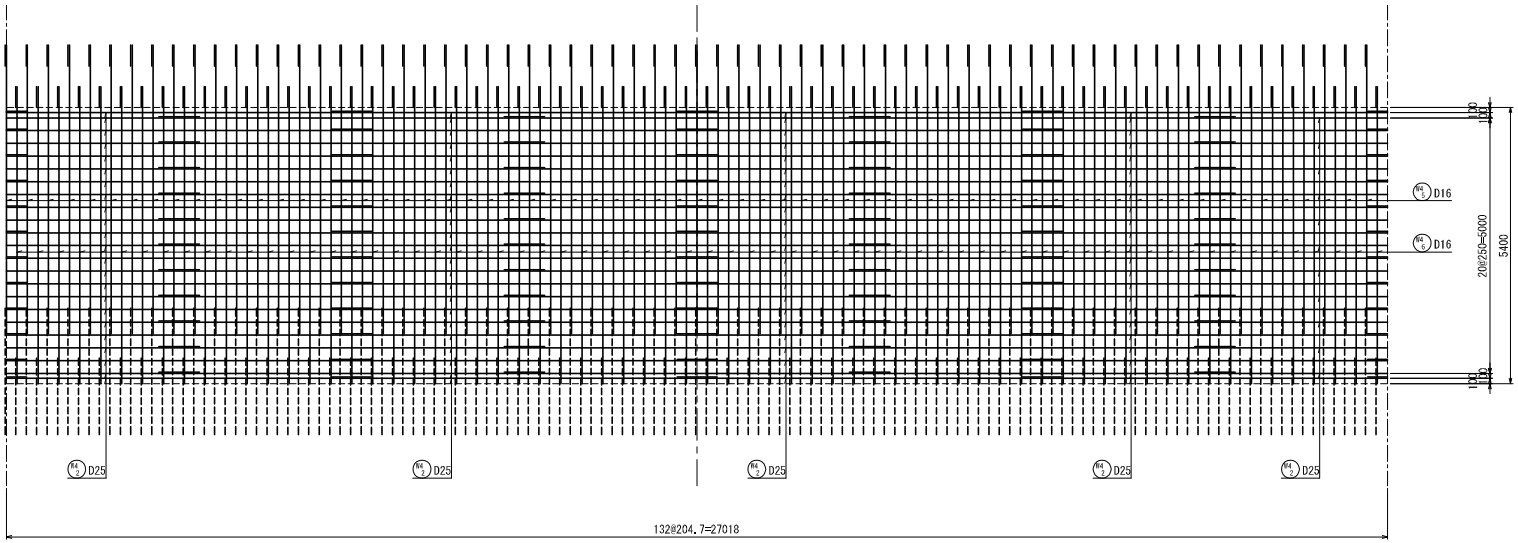
PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT A (12)
DRAWING NO:	RA - 12
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY

DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT A (13) S=1/50

(1ST STEP)



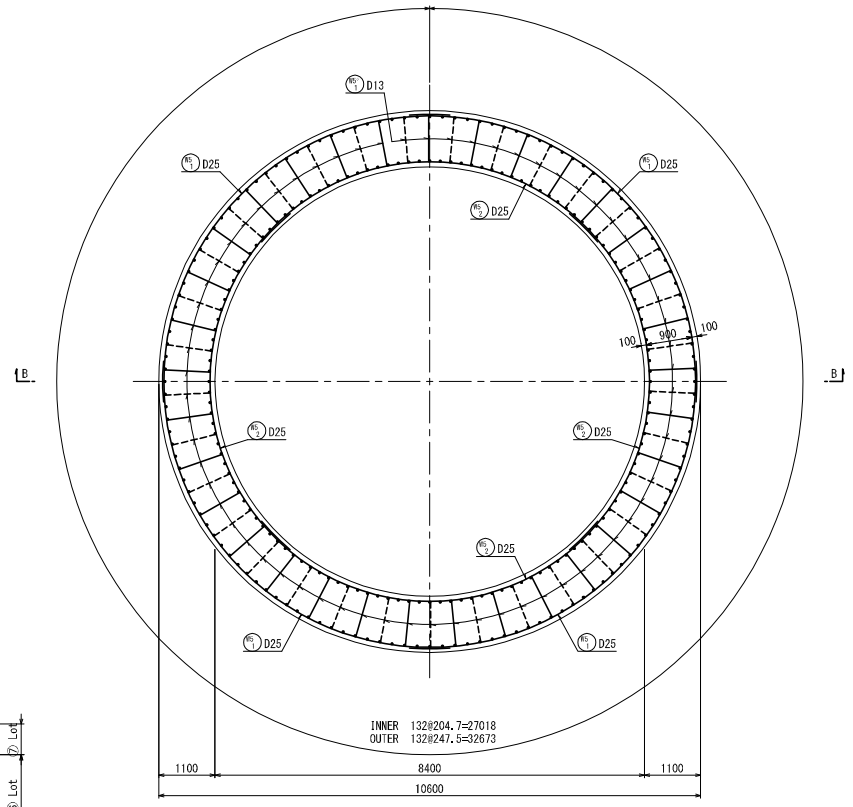
SIDEWALL(INNER)

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT A (13)		
DRAWING NO:	RA - 13		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

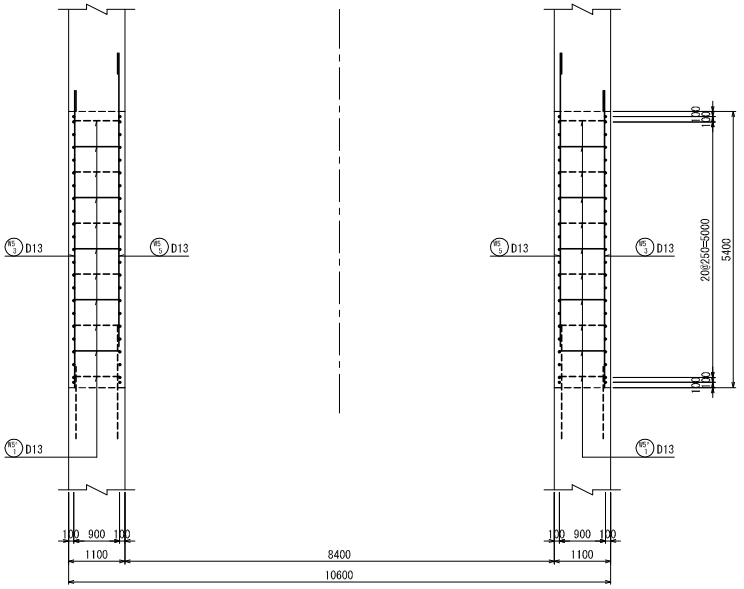
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT A (14) S=1/50

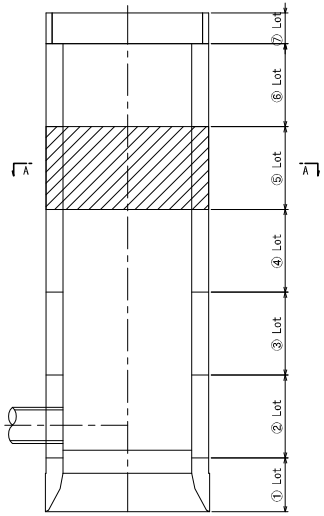
(1ST STEP)



A - A



B - B



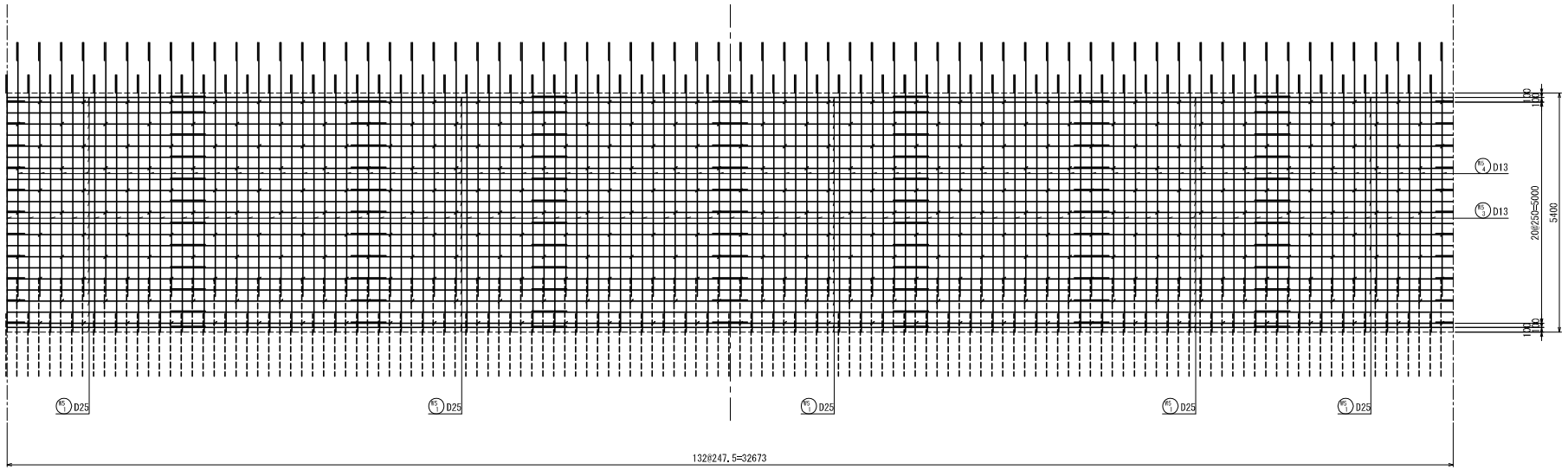
KEY PLAN

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT A (14)		
DRAWING NO:	RA - 14		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT A (15) S=1/50

(1ST STEP)



SIDEWALL (OUTER)

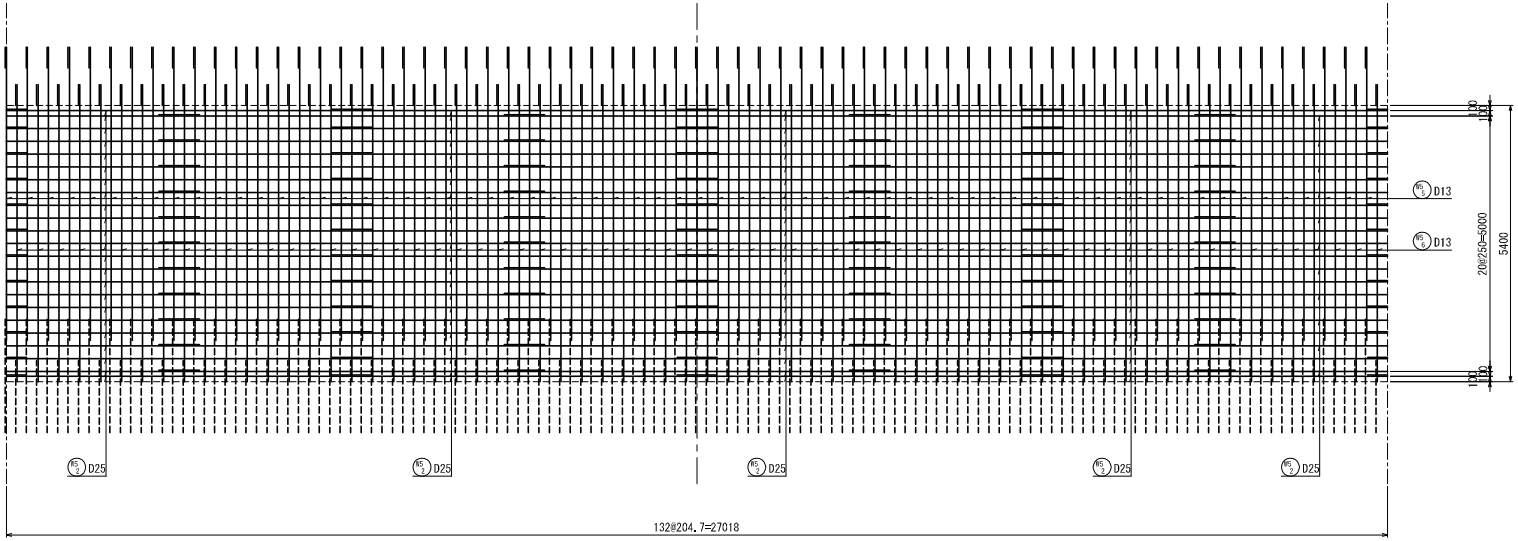
PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT A (15)
DRAWING NO:	RA - 15
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY

DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT A (16) S=1/50

(1ST STEP)



SIDEWALL(INNER)

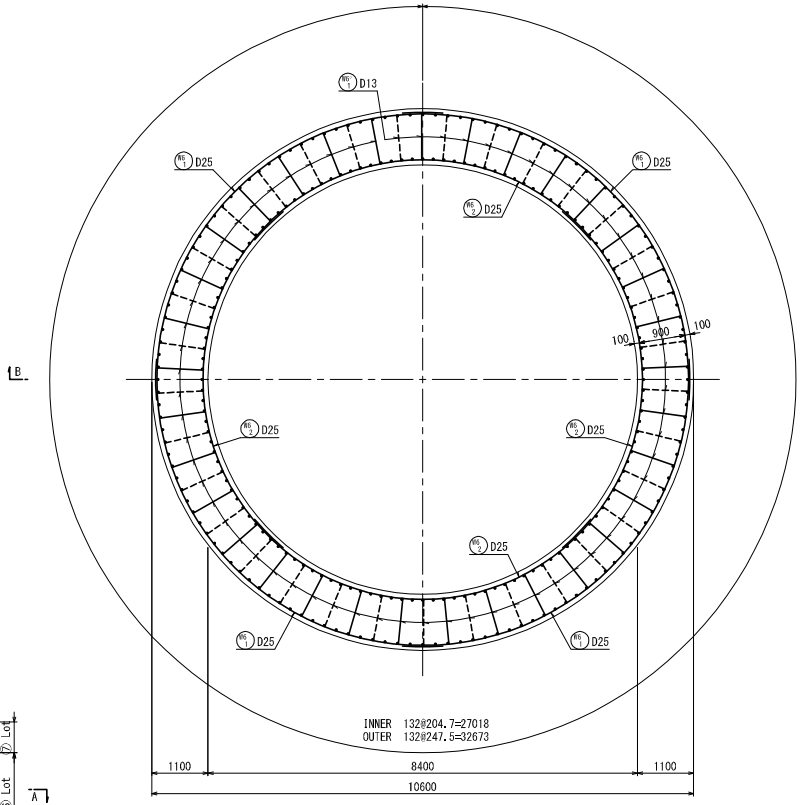
PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT A (16)
DRAWING NO:	RA - 16
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY

DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

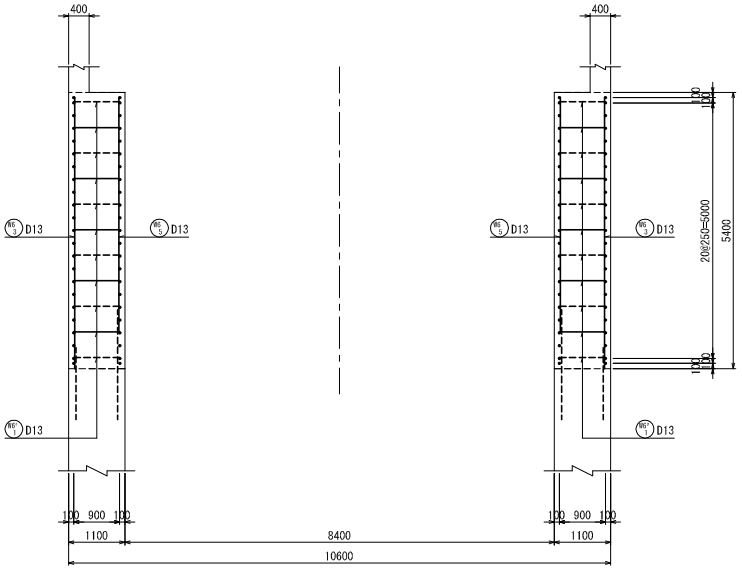
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT A (17) S=1/50

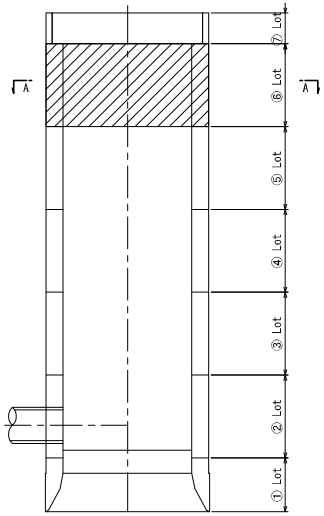
(1ST STEP)



A - A



B - B



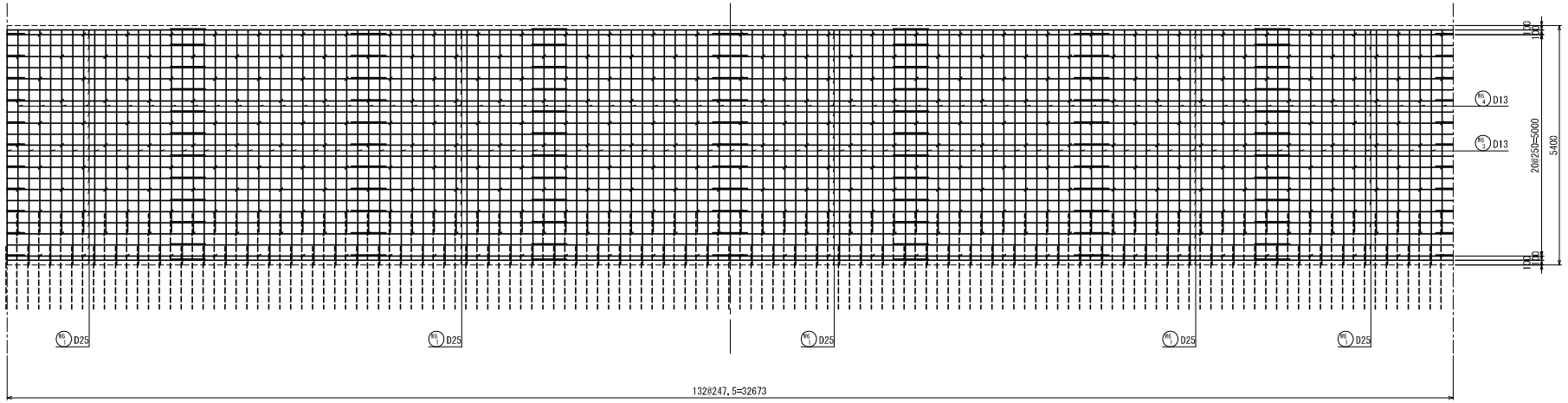
KEY PLAN

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT A (17)		
DRAWING NO:	RA - 17		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT A (18) S=1/50

(1ST STEP)



SIDEWALL(OUTER)

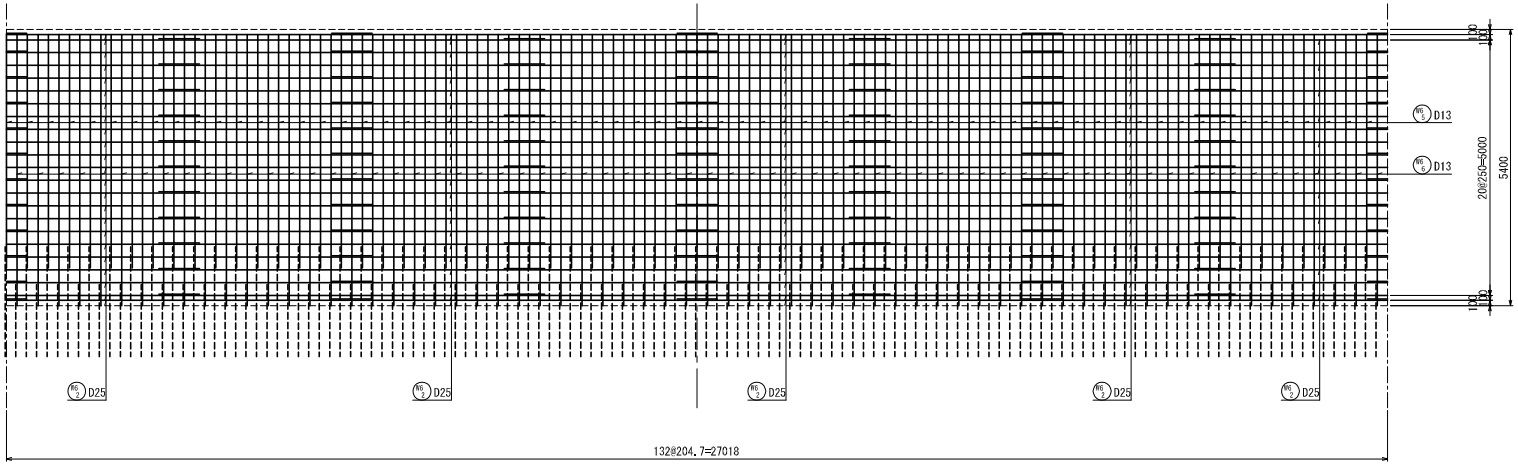
PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT A (18)
DRAWING NO:	RA - 18
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY

DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT A (19) S=1/50

(1ST STEP)



SIDEWALL(INNER)

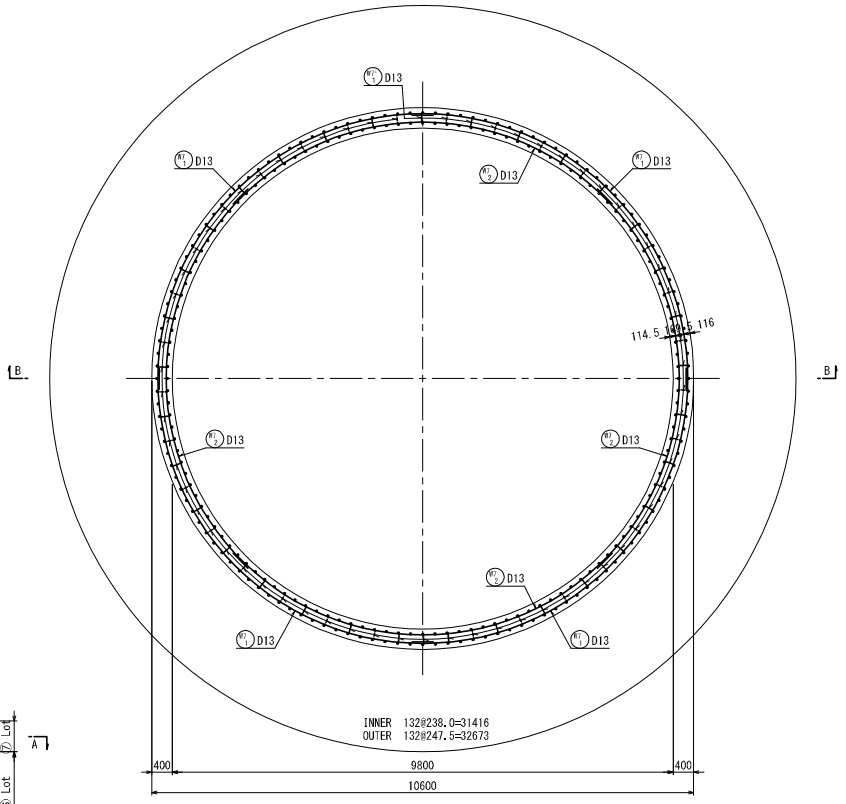
PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT A (19)
DRAWING NO:	RA - 19
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY

DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

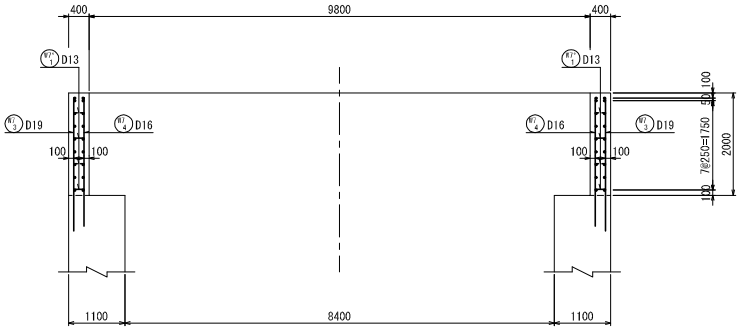
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT A (20) S=1/50

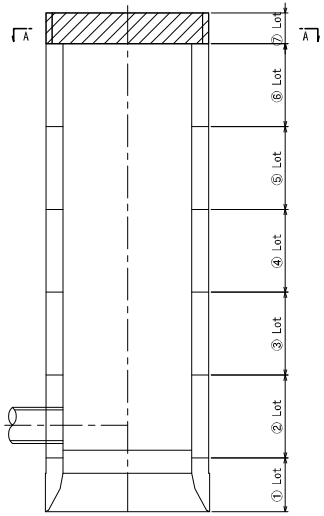
(1ST STEP)



A - A



B - B



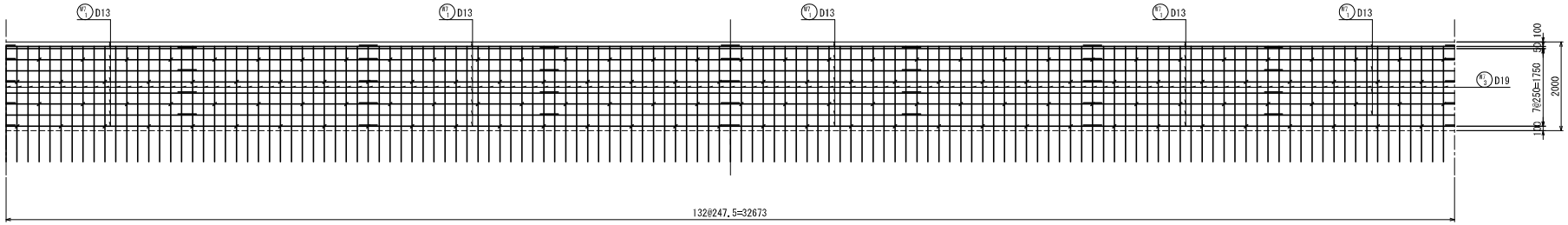
KEY PLAN

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT A (20)		
DRAWING NO:	RA - 20		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

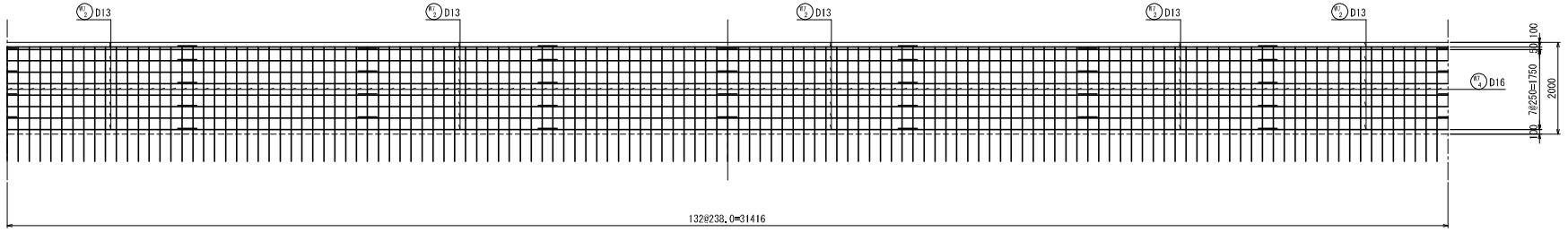
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT A (21) S=1/50

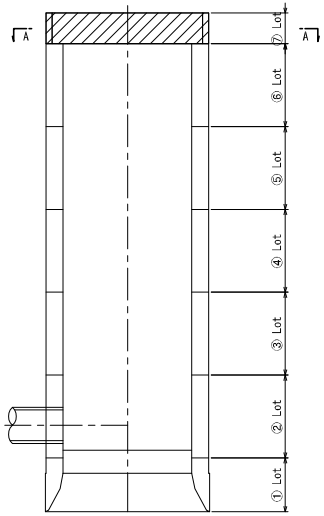
(1ST STEP)



SIDEWALL (OUTER)



SIDEWALL (INNER)



KEY PLAN

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT A (21)
DRAWING NO:	RA - 21
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY

DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

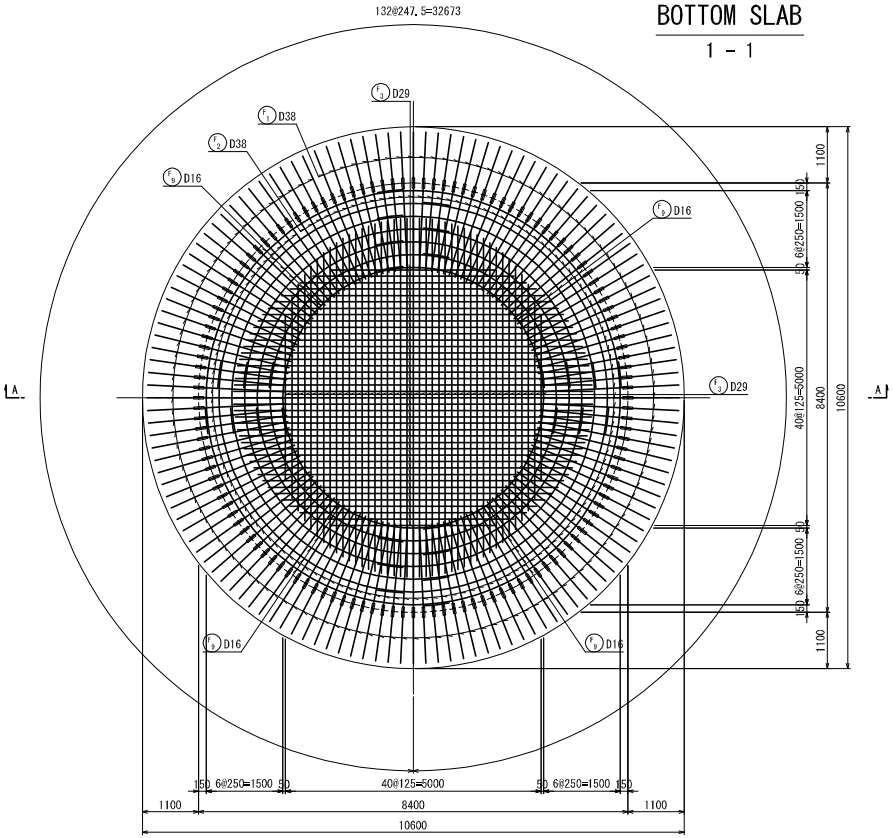
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT A (22) S=1/50

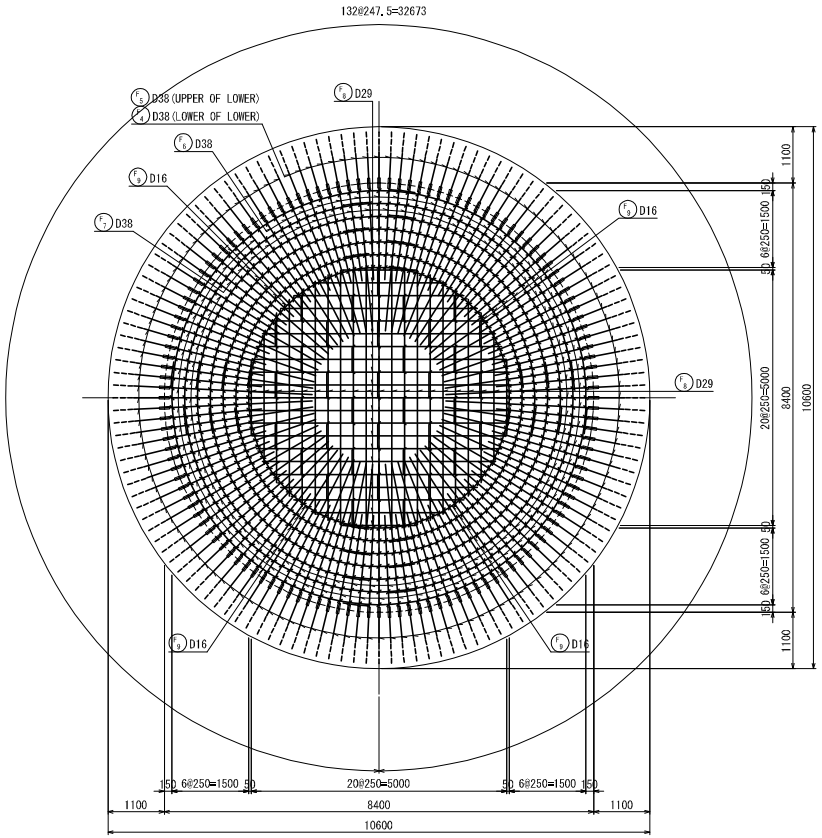
(1ST STEP)

BOTTOM SLAB

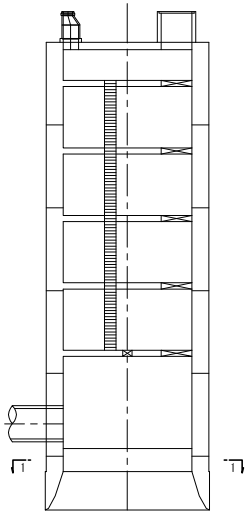
1 - 1



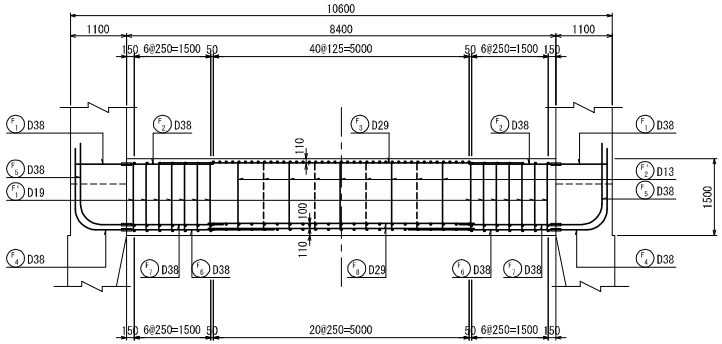
BOTTOM SLAB (UPPER)



BOTTOM SLAB (LOWER)



KEY PLAN



A - A

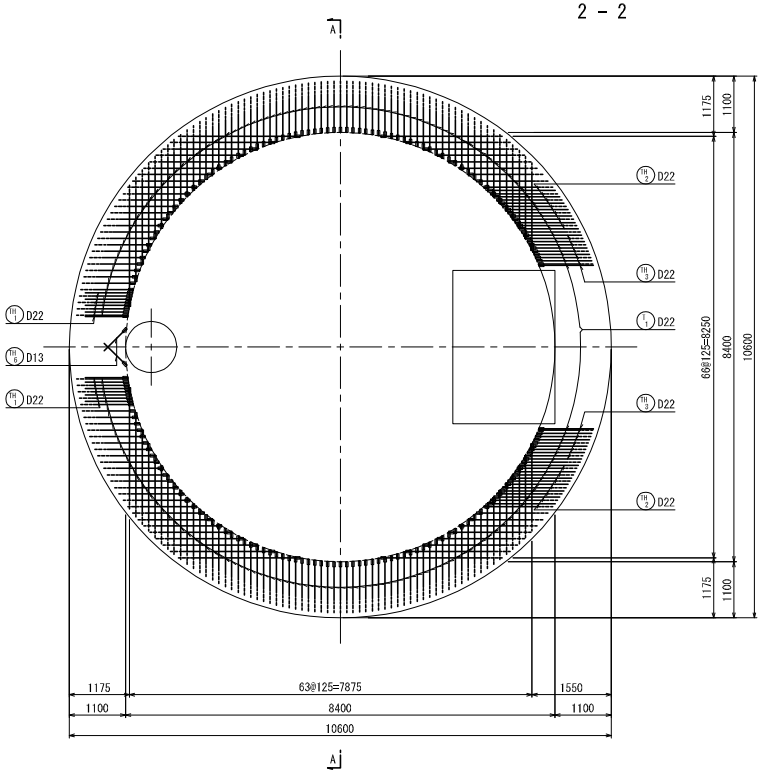
PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT A (22)		
DRAWING NO:	RA - 22		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	
Japan International Cooperation Agency			

RE-BAR ARRANGEMENT OF SHAFT A (23) S=1/50

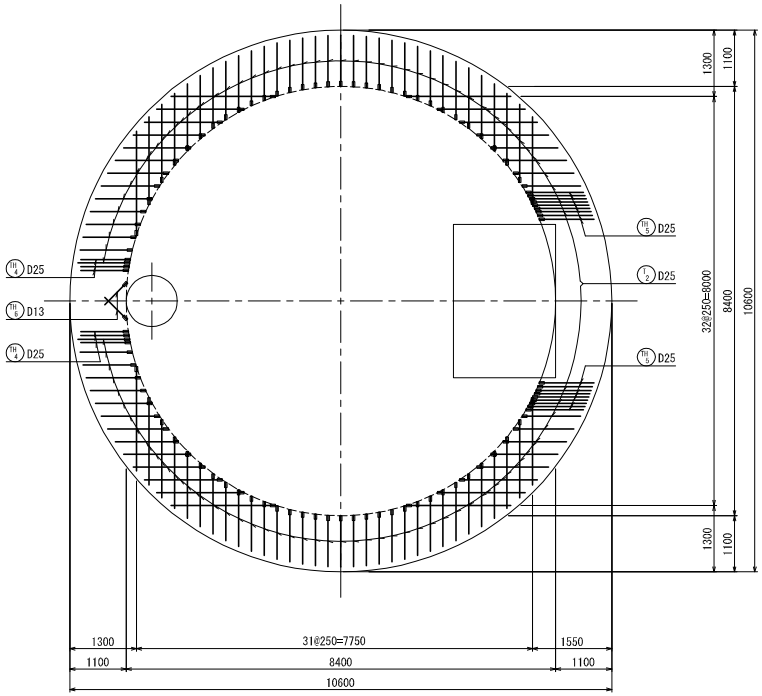
(1ST STEP)

TOP SLAB

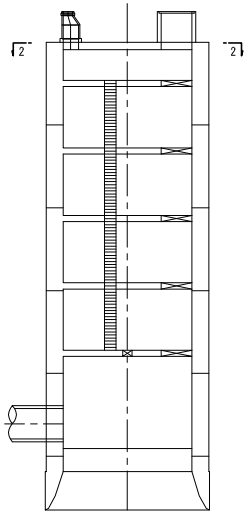
2 - 2



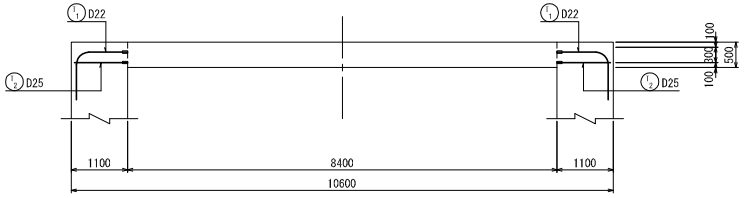
TOP SLAB (UPPER)



TOP SLAB (LOWER)



KEY PLAN



A - A

NOTE:

The structural calculation and the re-bar arrangement shall be reviewed when location and size of openings of slab are determined.

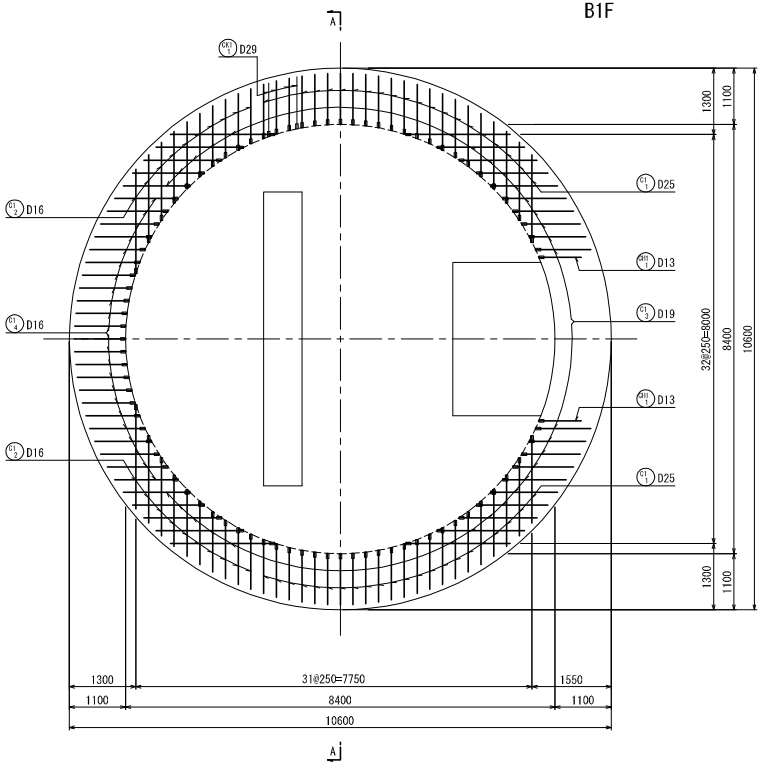
PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT A (23)		
DRAWING NO:	RA - 23		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	
JICA	Japan International Cooperation Agency		

RE-BAR ARRANGEMENT OF SHAFT A (24) S=1/50

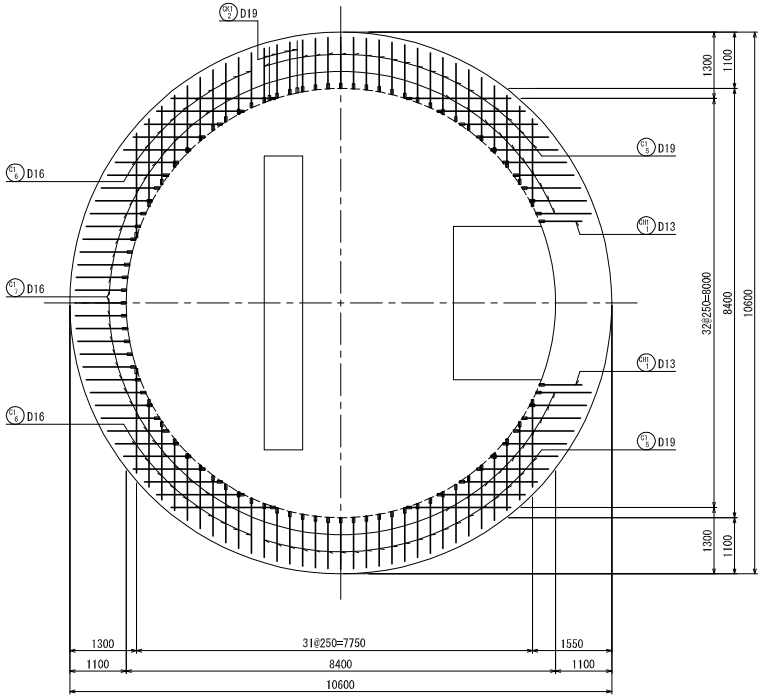
(1ST STEP)

MID SLAB-1

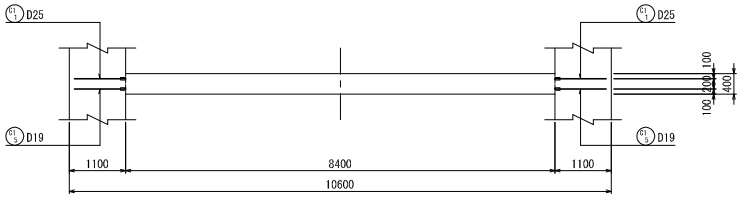
B1F



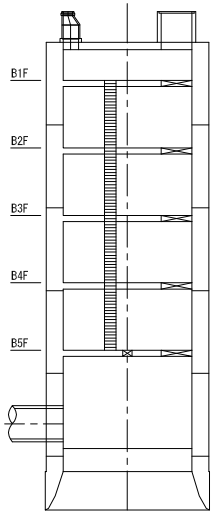
MID SLAB(UPPER)



MID SLAB(LOWER)



A - A



KEY PLAN

NOTE:

The structural calculation and the re-bar arrangement shall be reviewed when location and size of openings of slab are determined.

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT A (24)
DRAWING NO:	RA - 24
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY
DESIGNED BY:	SHIMAO HIDAKA — DATE:
CHECKED BY:	HARUTOSHI UCHIDA — DATE:

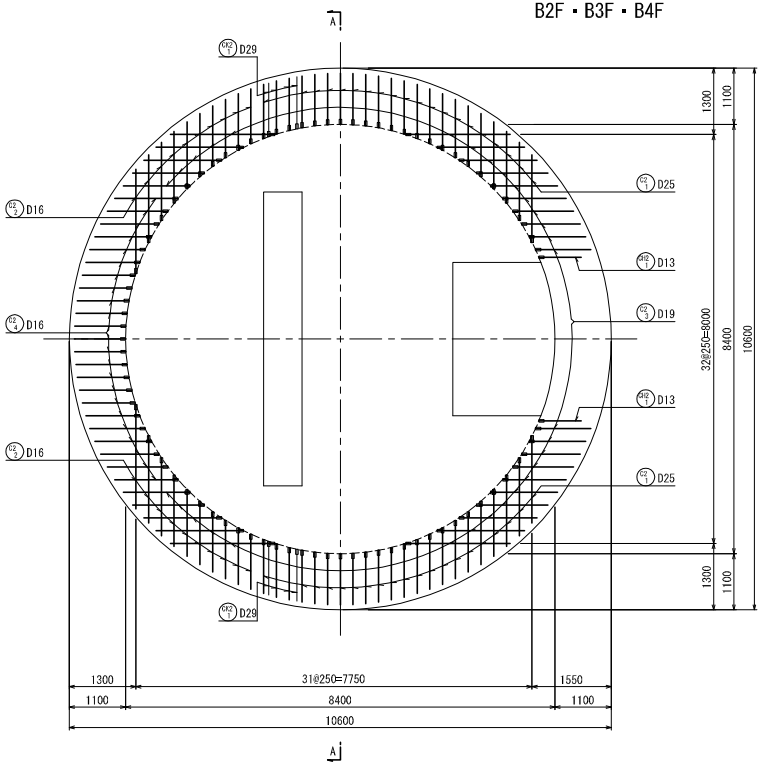
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT A (25) S=1/50

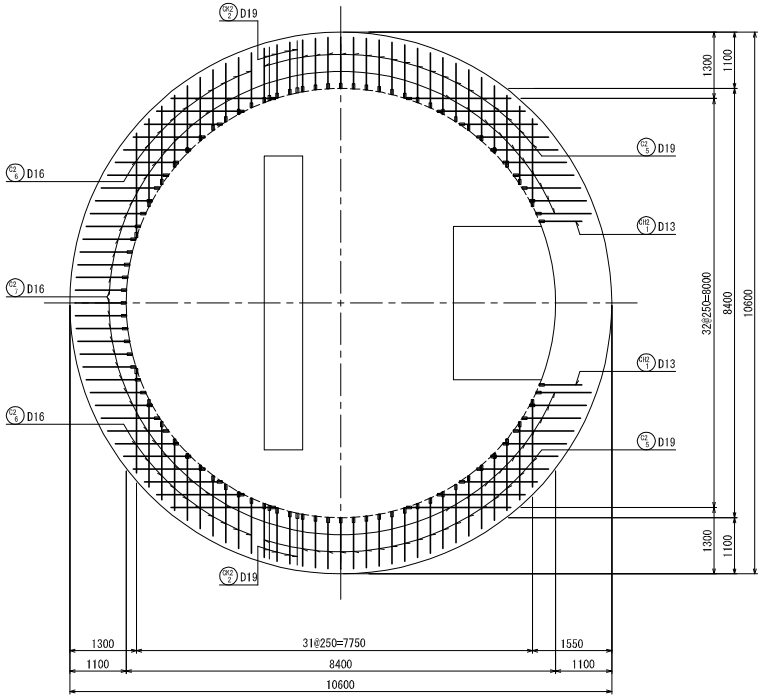
(1ST STEP)

MID SLAB-2

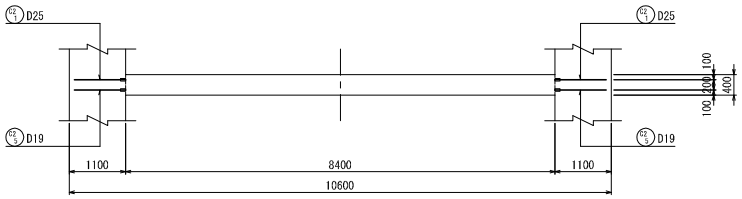
B2F・B3F・B4F



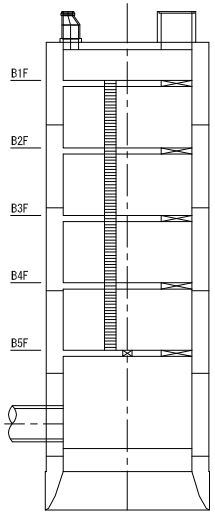
MID SLAB(UPPER)



MID SLAB(LOWER)



A - A



KEY PLAN

NOTE:

The structural calculation and the re-bar arrangement shall be reviewed when location and size of openings of slab are determined.

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT A (25)
DRAWING NO:	RA - 25
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY
DESIGNED BY:	SHIMAO HIDAKA — DATE:
CHECKED BY:	HARUTOSHI UCHIDA — DATE:

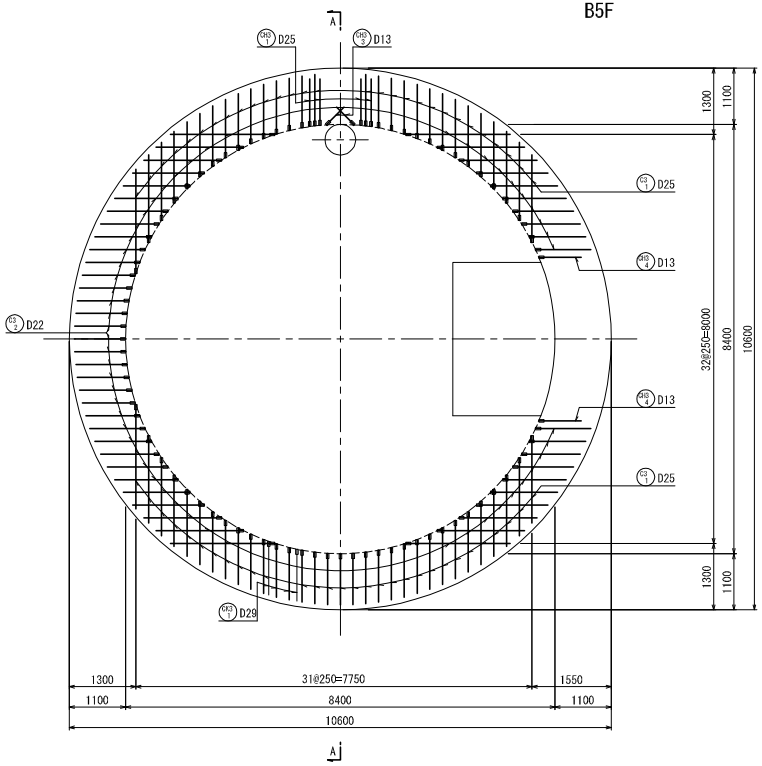
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT A (26) S=1/50

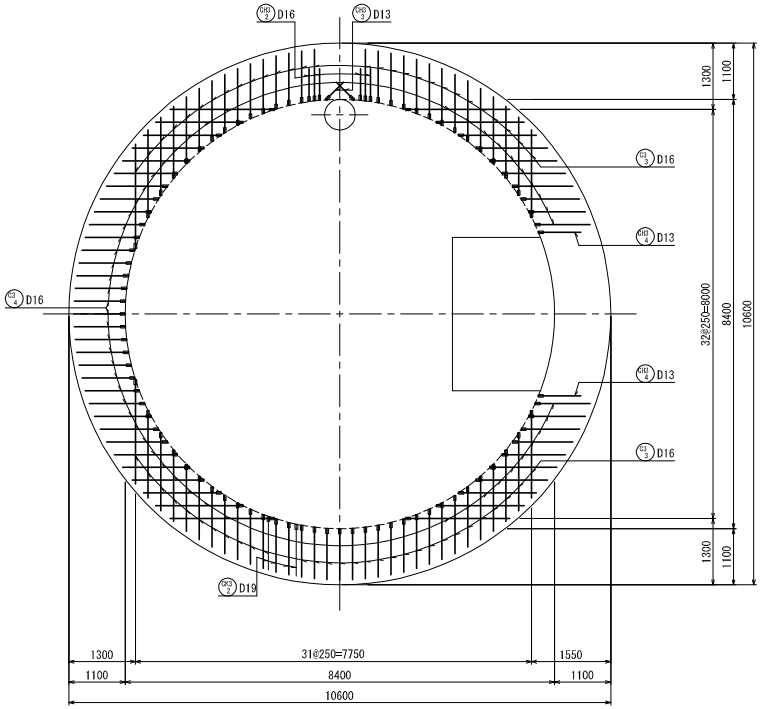
(1ST STEP)

MID SLAB-3

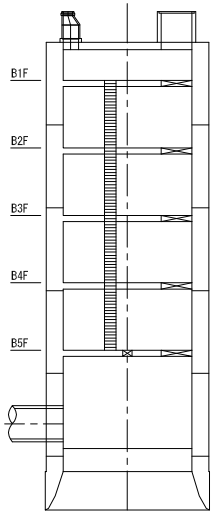
B5F



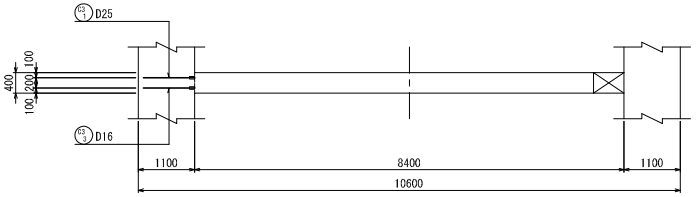
MID SLAB(UPPER)



MID SLAB(LOWER)



KEY PLAN



A - A

NOTE:

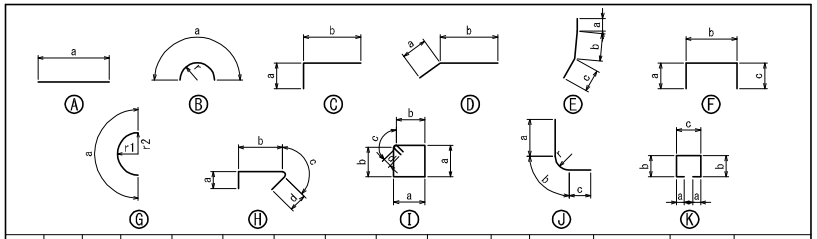
The structural calculation and the re-bar arrangement shall be reviewed when location and size of openings of slab are determined.

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT A (26)
DRAWING NO:	RA - 26
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY
DESIGNED BY: SHIMAO HIDAKA	DATE:
CHECKED BY: HARUTOSHI UCHIDA	DATE:

Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT A (27)

(1ST STEP)



No.	SIZE	TYPE	a	b	c	d	r (r1)	r2	LENGTH (mm)	NUMBER	UNIT WEIGHT	WEIGHT/N	WEIGHT (kg)	REMARK
SIDEWALL : ①LOT														
W1 1	D 25	B	8,958				5,200		8,960	20	3.98	35.66	713	
2	D 13	B	8,657				5,250		8,660	36	0.995	8.62	310	
3	D 25	B	7,544				4,300		7,550	16	3.98	30.05	481	
4	D 13	B	7,199 ~8,425				4,322 ~5,103		7,820	36	0.995	7.78	280	(Av. LENGTH)
5	D 22	A	2,480						2,480	66	3.04	7.54	498	
6	D 22	A	3,895						3,900	60	3.04	11.86	712	
7	D 22	A	2,659 ~3,556						3,110	6	3.04	9.45	57	(Av. LENGTH)
8	D 22	C	2,238	928					3,170	132	3.04	9.64	1,272	
9	D 19	D	600	2,903					3,510	59	2.25	7.90	466	
10	D 19	D	600	1,678					2,280	66	2.25	5.13	339	
11	D 19	D	600	1,923 ~2,795					2,960	7	2.25	6.66	47	(Av. LENGTH)
12	D 16	E	500	995	1,542				3,040	132	1.56	4.74	626	
W1' 1	D 13	F	100	938	100				1,140	66	0.995	1.13	75	
2	D 13	F	100	179 ~860	100				720	132	0.995	0.72	95	(Av. LENGTH)

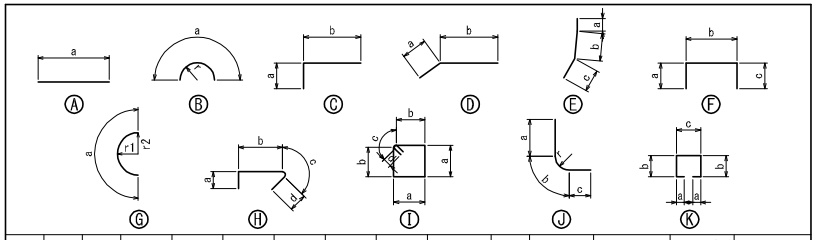
D25	1,194 kg
D22	2,539 kg
D19	852 kg
D16	626 kg
D13	760 kg
TOTAL	5,971 kg

RE-BAR BENDING SCHEDULE

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT A (27)		
DRAWING NO:	RA - 27		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	
Japan International Cooperation Agency			

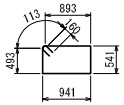
RE-BAR ARRANGEMENT OF SHAFT A (28)

(1ST STEP)



No.	SIZE	TYPE	a	b	c	d	r (r1)	r2	LENGTH (mm)	NUMBER	UNIT WEIGHT	WEIGHT/N	WEIGHT (kg)	REMARK
SIDEWALL : ②LOT														
W2 1	D 25	B	8,958				5,200		8,960	65	3.98	35.66	2,318	
2	D 25	B	8,958				5,200		8,960	12	3.98	35.66	428	
3	D 25	B	7,278 ~7,878				5,200		7,580	10	3.98	30.17	302	(Av. LENGTH)
4	D 25	B	3,202 ~3,967				5,200		3,590	10	3.98	14.29	143	(Av. LENGTH)
5	D 25	B	7,544				4,300		7,550	65	3.98	30.05	1,953	
6	D 25	B	7,544				4,300		7,550	12	3.98	30.05	361	
7	D 25	B	2,480 ~3,084				4,300		2,790	10	3.98	11.10	111	(Av. LENGTH)
8	D 25	B	5,867 ~6,635				4,300		6,260	10	3.98	24.91	249	(Av. LENGTH)
9	D 29	A	6,090						6,090	121	5.04	30.69	3,713	
10	D 29	A	845 ~1,304						1,080	5	5.04	5.44	27	(Av. LENGTH)
11	D 29	A	2,695 ~3,154						2,930	5	5.04	14.77	74	(Av. LENGTH)
12	D 29	A	4,134 ~5,031						4,590	6	5.04	23.13	139	(Av. LENGTH)
13	D 25	A	6,000						6,000	119	3.98	23.88	2,842	
14	D 25	A	861 ~1,339						1,100	6	3.98	4.38	26	(Av. LENGTH)
15	D 25	A	2,621 ~3,099						2,860	6	3.98	11.38	68	(Av. LENGTH)
16	D 25	A	3,830 ~4,702						4,270	7	3.98	16.99	119	(Av. LENGTH)
WH2 1	D 13	A	3,383						3,390	4	0.995	3.37	13	
2	D 13	G	4,436				1,288	1,275	4,440	2	0.995	4.42	9	
3	D 13	A	3,389						3,390	4	0.995	3.37	13	
4	D 13	G	4,446				1,294	1,275	4,450	2	0.995	4.43	9	
W2° 1	D 13	F	100	938	100				1,140	99	0.995	1.13	112	
2	D 16	H	240	113	893	160	48		1,410	1764	1.56	2.20	3,881	
3	D 16	L							3,420	132	1.56	5.34	705	
											D29	3,953 kg		
											D25	8,920 kg		
											D16	4,586 kg		
											D13	156 kg		
											TOTAL	17,615 kg		
SIDEWALL : ③LOT														
W3 1	D 25	B	8,958				5,200		8,960	92	3.98	35.66	3,281	
2	D 25	B	7,544				4,300		7,550	92	3.98	30.05	2,765	
3	D 22	A	5,900						5,900	66	3.04	17.94	1,184	
4	D 22	A	5,535						5,540	66	3.04	16.84	1,111	
5	D 19	A	5,650						5,650	66	2.25	12.71	839	
6	D 19	A	5,900						5,900	66	2.25	13.28	876	
W3° 1	D 13	F	100	938	100				1,140	363	0.995	1.13	410	
											D25	6,046 kg		
											D22	2,295 kg		
											D19	1,715 kg		
											D13	410 kg		
											TOTAL	10,466 kg		

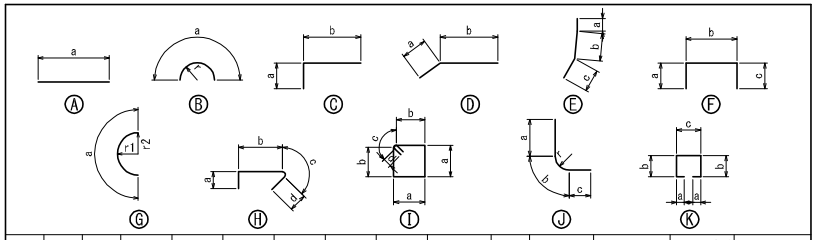
RE-BAR BENDING SCHEDULE



PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT A (28)		
DRAWING NO:	RA - 28		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	
Japan International Cooperation Agency			

RE-BAR ARRANGEMENT OF SHAFT A (29)

(1ST STEP)



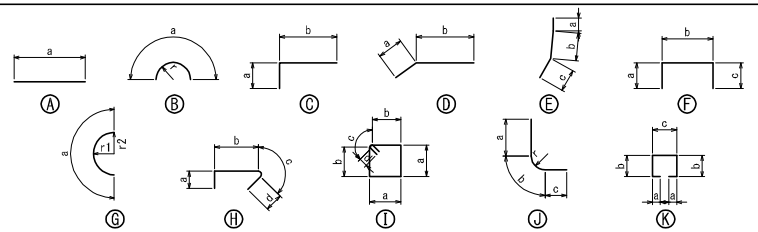
No.	SIZE	TYPE	a	b	c	d	r (r1)	r2	LENGTH (mm)	NUMBER	UNIT WEIGHT	WEIGHT/N	WEIGHT (kg)	REMARK
SIDEWALL : ④LOT														
W4 1	D 25	B	8,958				5,200		8,960	92	3.98	35.66	3,281	
2	D 25	B	7,544				4,300		7,550	92	3.98	30.05	2,765	
3	D 16	A	5,810						5,810	66	1.56	9.06	598	
4	D 16	A	5,570						5,570	66	1.56	8.69	574	
5	D 16	A	5,645						5,650	66	1.56	8.81	581	
6	D 16	A	5,810						5,810	66	1.56	9.06	598	
W4' 1	D 13	F	100	938	100				1,140	363	0.995	1.13	410	
											D25	6,046 kg		
											D16	2,351 kg		
											D13	410 kg		
											TOTAL	8,807 kg		
SIDEWALL : ⑤LOT														
W5 1	D 25	B	8,958				5,200		8,960	92	3.98	35.66	3,281	
2	D 25	B	7,544				4,300		7,550	92	3.98	30.05	2,765	
3	D 13	A	5,810						5,810	66	0.995	5.78	381	
4	D 13	A	5,735						5,740	66	0.995	5.71	377	
5	D 13	A	5,735						5,740	66	0.995	5.71	377	
6	D 13	A	5,810						5,810	66	0.995	5.78	381	
W5' 1	D 13	F	100	938	100				1,140	363	0.995	1.13	410	
											D25	6,046 kg		
											D13	1,926 kg		
											TOTAL	7,972 kg		
SIDEWALL : ⑥LOT														
W6 1	D 25	B	8,958				5,200		8,960	92	3.98	35.66	3,281	
2	D 25	B	7,544				4,300		7,550	92	3.98	30.05	2,765	
3	D 13	A	5,300						5,300	66	0.995	5.27	348	
4	D 13	A	4,565						4,570	66	0.995	4.55	300	
5	D 13	A	4,565						4,570	66	0.995	4.55	300	
6	D 13	A	5,300						5,300	66	0.995	5.27	348	
W6' 1	D 13	F	100	938	100				1,140	363	0.995	1.13	410	
											D25	6,046 kg		
											D13	1,706 kg		
											TOTAL	7,752 kg		

RE-BAR BENDING SCHEDULE

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT A (29)		
DRAWING NO:	RA - 29		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	
Japan International Cooperation Agency			

RE-BAR ARRANGEMENT OF SHAFT A (30)

(1ST STEP)



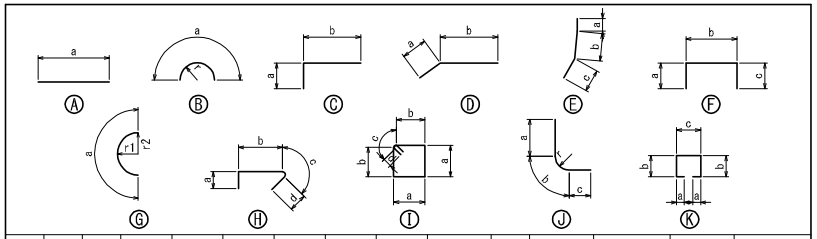
No.	SIZE	TYPE	a	b	c	d	r(r1)	r2	LENGTH(mm)	NUMBER	UNIT WEIGHT	WEIGHT/N	WEIGHT(kg)	REMARK
SIDEWALL : ⑦LOT														
W7 1	D 13	B	8,578				5,200		8,580	36	0.995	8.54	307	
2	D 13	B	8,264				5,000		8,270	36	0.995	8.23	296	
3	D 19	A	2,600						2,600	132	2.25	5.85	772	
4	D 16	A	2,500						2,500	132	1.56	3.90	515	
W7' 1	D 13	F	100	231	100				440	132	0.995	0.44	58	
											D19	772 kg		
											D16	515 kg		
											D13	661 kg		
											TOTAL	1,948 kg		
BOTTOM SLAB														
F 1	D 38	A	1,000						1,000	132	8.95	8.95	1,181	(M.S.)
2	D 38	A	1,700						1,700	132	8.95	15.22	2,009	(M.S.)
3	D 29	A	3,248 ~7,020						5,140	82	5.04	25.91	2,125	(Av.LENGTH)
4	D 38	J	1,190	628	600		400		2,420	132	8.95	21.66	2,859	(M.S.)
5	D 38	J	1,190	628	500		400		2,320	132	8.95	20.76	2,740	(M.S.)
6	D 38	A	2,890						2,890	132	8.95	25.87	3,415	(M.S.)
7	D 38	A	1,890						1,890	132	8.95	16.92	2,233	(M.S.)
8	D 29	A	1,428 ~5,200						3,320	84	5.04	16.73	1,405	(Av.LENGTH)
9	D 16	B	4,506 ~6,862				2,550 ~4,050		5,690	84	1.56	8.88	746	(Av.LENGTH)
F' 1	D 19	H	285	1,280	134	190	57		1,890	924	2.25	4.25	3,927	
2	D 13	K	100	1,322	542				3,390	37	0.995	3.37	125	
											D38	14,437 kg		
MECHANICAL SPLICE(M.S.) NUMBER D38 396 UNIT											D29	3,530 kg		
											D19	3,927 kg		
											D16	746 kg		
											D13	125 kg		
											TOTAL	22,765 kg		
TOP SLAB														
T 1	D 22	J	690	377	760 ~2,136		240		2,520	228	3.04	7.66	1,746	(Av.LENGTH) (M.S.)
2	D 25	A	1,000 ~2,042						1,530	112	3.98	6.09	682	(Av.LENGTH) (M.S.)
TH 1	D 22	A	833 ~927						880	10	3.04	2.68	27	(Av.LENGTH) (M.S.)
2	D 22	C	332 ~787	1,151 ~1,328					1,800	14	3.04	5.47	77	(Av.LENGTH) (M.S.)
3	D 22	C	330	1,064 ~1,132					1,430	12	3.04	4.35	52	(Av.LENGTH) (M.S.)
4	D 25	A	933 ~969						960	6	3.98	3.82	23	(Av.LENGTH) (M.S.)
5	D 25	C	375	1,064 ~1,132					1,470	14	3.98	5.85	82	(Av.LENGTH) (M.S.)
6	D 13	A	615						620	4	0.995	0.62	2	(M.S.)
											D25	787 kg		
MECHANICAL SPLICE(M.S.) NUMBER D25 132 UNIT											D22	1,902 kg		
D22 264 UNIT											D13	2 kg		
D13 4 UNIT											TOTAL	2,691 kg		

RE-BAR BENDING SCHEDULE

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT A (30)		
DRAWING NO:	RA - 30		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	
JICA	Japan International Cooperation Agency		

RE-BAR ARRANGEMENT OF SHAFT A (31)

(1ST STEP)



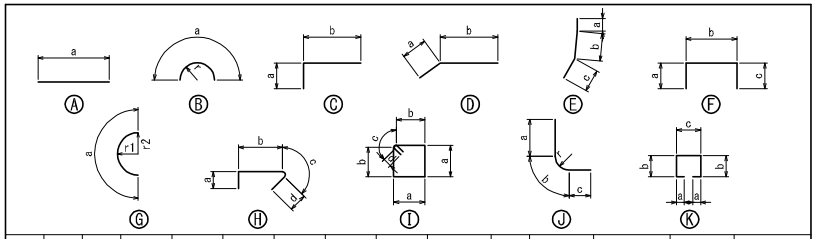
No.	SIZE	TIPE	a	b	c	d	r(r1)	r2	LENGTH(mm)	NUMBER	UNIT WEIGHT	WEIGHT/N	WEIGHT(kg)	REMARK
MID SLAB-1 (B1F)														
C1 1	D 25	A	1,000 ~1,711						1,360	42	3.98	5.41	227	(Av.LENGTH) (M.S.)
2	D 16	A	1,079 ~2,042						1,560	20	1.56	2.43	49	(Av.LENGTH) (M.S.)
3	D 19	A	1,079 ~2,042						1,560	30	2.25	3.51	105	(Av.LENGTH) (M.S.)
4	D 16	A	1,000 ~1,239						1,120	23	1.56	1.75	40	(Av.LENGTH) (M.S.)
5	D 19	A	1,000 ~1,711						1,360	42	2.25	3.06	129	(Av.LENGTH) (M.S.)
6	D 16	A	1,079 ~2,042						1,560	20	1.56	2.43	49	(Av.LENGTH) (M.S.)
7	D 16	A	1,000 ~2,042						1,530	53	1.56	2.39	127	(Av.LENGTH) (M.S.)
CH1 1	D 13	A	827						830	4	0.995	0.83	3	(M.S.)
CK1 1	D 29	A	1,017 ~1,048						1,040	4	5.04	5.24	21	(Av.LENGTH) (M.S.)
2	D 19	A	1,017 ~1,048						1,040	4	2.25	2.34	9	(Av.LENGTH) (M.S.)
MECHANICAL SPLICE(M.S.) NUMBER									D29 4 UNIT		D29	21 kg		
									D25 42 UNIT		D25	227 kg		
									D19 76 UNIT		D19	243 kg		
									D16 116 UNIT		D16	265 kg		
									D13 4 UNIT		D13	3 kg		
											TOTAL	759 kg		
MID SLAB-2:PER ONEUNIT (B2F~B4F)														
C2 1	D 25	A	1,000 ~1,711						1,360	40	3.98	5.41	216	(Av.LENGTH) (M.S.)
2	D 16	A	1,079 ~2,042						1,560	20	1.56	2.43	49	(Av.LENGTH) (M.S.)
3	D 19	A	1,079 ~2,042						1,560	30	2.25	3.51	105	(Av.LENGTH) (M.S.)
4	D 16	A	1,000 ~1,239						1,120	23	1.56	1.75	40	(Av.LENGTH) (M.S.)
5	D 19	A	1,000 ~1,711						1,360	40	2.25	3.06	122	(Av.LENGTH) (M.S.)
6	D 16	A	1,079 ~2,042						1,560	20	1.56	2.43	49	(Av.LENGTH) (M.S.)
7	D 16	A	1,000 ~2,042						1,530	53	1.56	2.39	127	(Av.LENGTH) (M.S.)
CH2 1	D 13	A	827						830	4	0.995	0.83	3	(M.S.)
CK2 1	D 29	A	1,017 ~1,048						1,040	8	5.04	5.24	42	(Av.LENGTH) (M.S.)
2	D 19	A	1,017 ~1,048						1,040	8	2.25	2.34	19	(Av.LENGTH) (M.S.)
MECHANICAL SPLICE(M.S.) NUMBER									D29 8 UNIT		D29	42 kg		
									D25 40 UNIT		D25	216 kg		
									D19 78 UNIT		D19	246 kg		
									D16 116 UNIT		D16	265 kg		
									D13 4 UNIT		D13	3 kg		
											TOTAL	772 kg		

RE-BAR BENDING SCHEDULE

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT A (31)		
DRAWING NO:	RA - 31		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	
JICA	Japan International Cooperation Agency		

RE-BAR ARRANGEMENT OF SHAFT A (32)

(1ST STEP)



No.	SIZE	TIPE	a	b	c	d	r (r1)	r2	LENGTH (mm)	NUMBER	UNIT WEIGHT	WEIGHT/N	WEIGHT (kg)	REMARK
MID SLAB-3 (B5F)														
C3 1	D 25	A	1,000 ~2,042						1,530	58	3.98	6.09	353	(Av. LENGTH) (M.S.)
2	D 22	A	1,000 ~2,042						1,530	53	3.04	4.65	246	(Av. LENGTH) (M.S.)
3	D 16	A	1,000 ~2,042						1,530	58	1.56	2.39	139	(Av. LENGTH) (M.S.)
4	D 16	A	1,000 ~2,042						1,530	53	1.56	2.39	127	(Av. LENGTH) (M.S.)
CH3 1	D 25	A	909 ~933						930	4	3.98	3.70	15	(Av. LENGTH) (M.S.)
2	D 16	A	619 ~643						640	4	1.56	1.00	4	(Av. LENGTH) (M.S.)
3	D 13	A	488						490	4	0.995	0.49	2	(M.S.)
4	D 13	A	827						830	4	0.995	0.83	3	(M.S.)
CK3 1	D 29	A	1,017 ~1,048						1,040	4	5.04	5.24	21	(Av. LENGTH) (M.S.)
2	D 19	A	1,017 ~1,048						1,040	4	2.25	2.34	9	(Av. LENGTH) (M.S.)

MECHANICAL SPLICE (M.S.) NUMBER				
D29	4 UNIT	D29	21 kg	
D25	62 UNIT	D25	368 kg	
D22	53 UNIT	D22	246 kg	
D19	4 UNIT	D19	9 kg	
D16	115 UNIT	D16	270 kg	
D13	8 UNIT	D13	5 kg	
		TOTAL	919 kg	

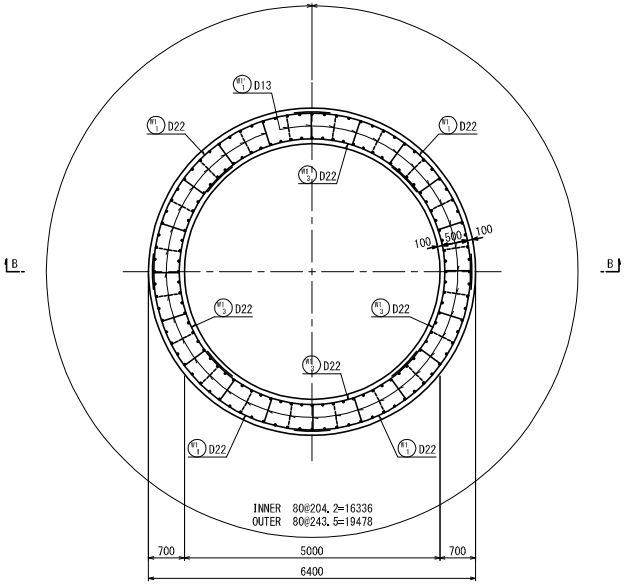
TOTAL NUMBER OF MECHANICAL SPLICE		TOTAL WEIGHT OF RE-BAR	
D38	396 UNIT	D38	14,437 kg
D29	32 UNIT	D29	7,651 kg
D25	356 UNIT	D25	36,328 kg
D22	317 UNIT	D22	6,982 kg
D19	314 UNIT	D19	8,256 kg
D16	579 UNIT	D16	10,154 kg
D13	28 UNIT	D13	6,173 kg
TOTAL	2,022 UNIT	TOTAL	89,981 kg

RE-BAR BENDING SCHEDULE

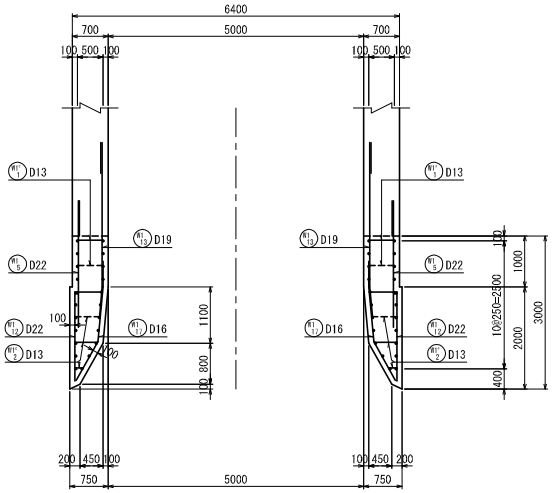
PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT A (32)
DRAWING NO:	RA - 32
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY
DESIGNED BY: SHIMAO HIDAKA	DATE:
CHECKED BY: HARUTOSHI UCHIDA	DATE:
Japan International Cooperation Agency	

RE-BAR ARRANGEMENT OF SHAFT B （1） S=1/50

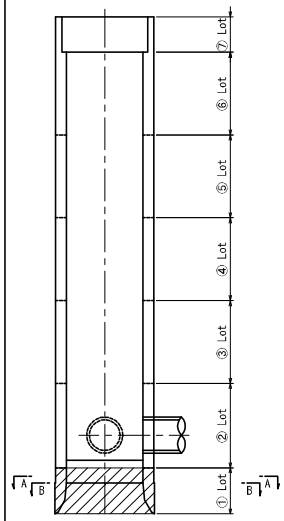
(1ST STEP)



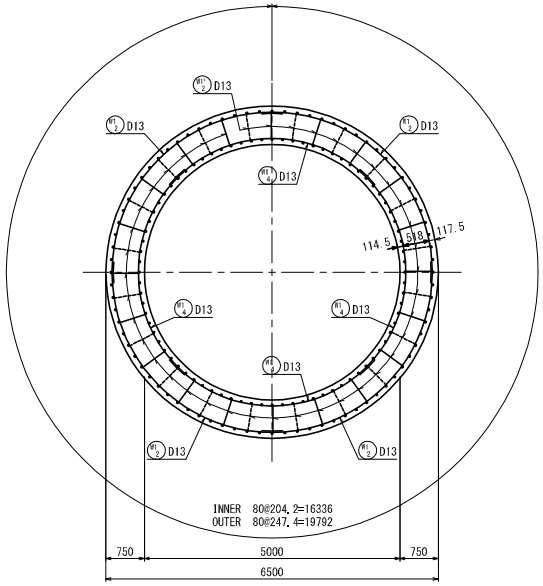
A - A



C - C



KEY PLAN



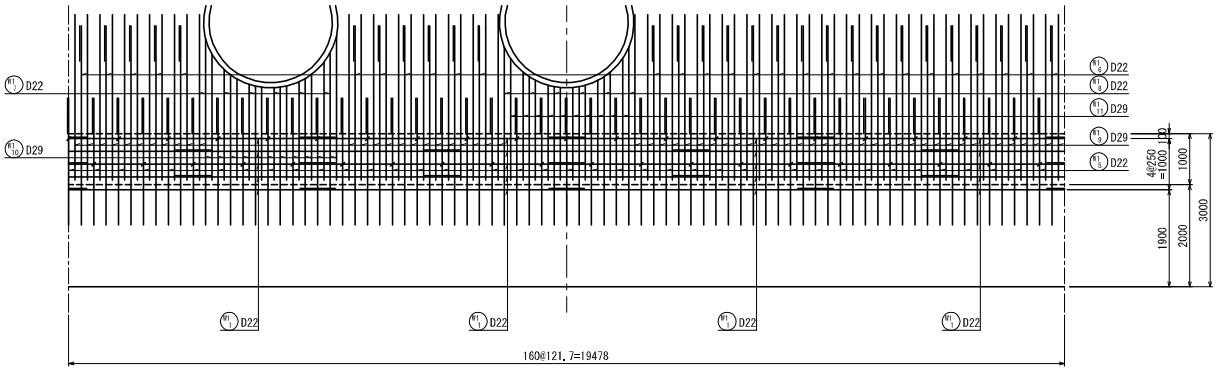
B - B

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (1)		
DRAWING NO:	RB - 01		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

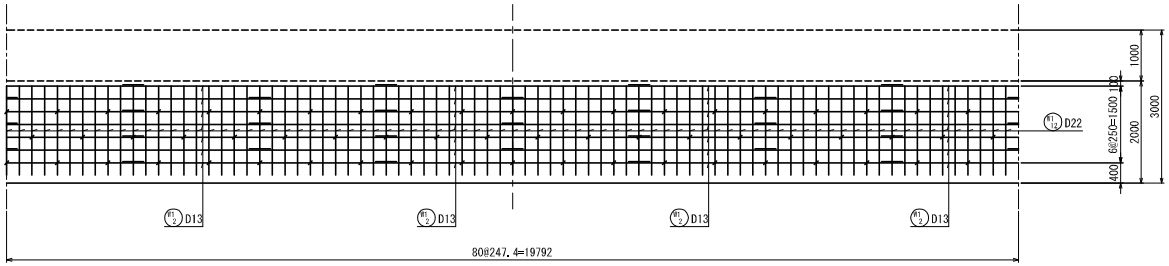
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT B (2) S=1/50

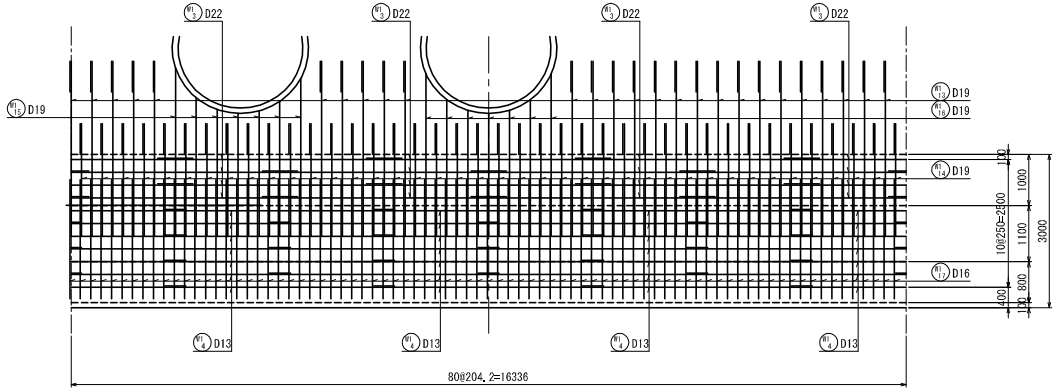
(1ST STEP)



SIDEWALL(TOE OF SHAFT)



SIDEWALL()

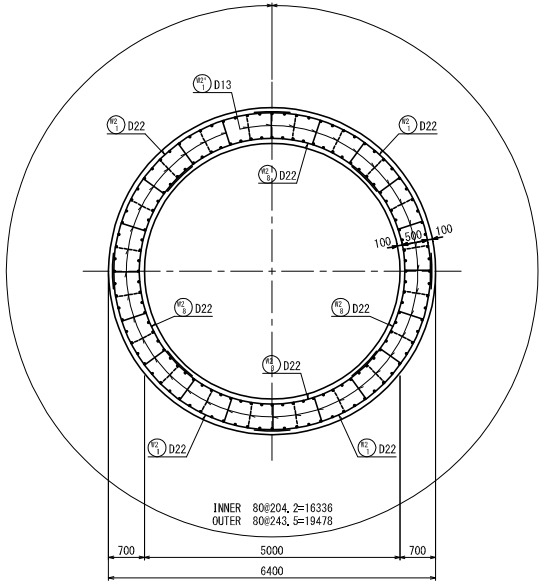


SIDEWALL(INNER)

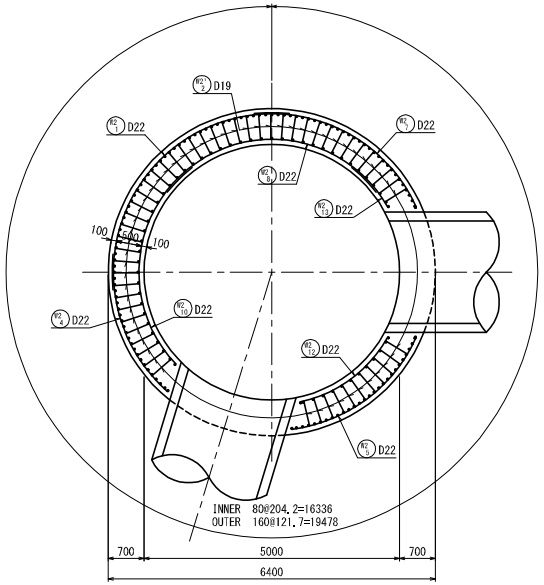
PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (2)		
DRAWING NO:	RB - 02		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	
JICA	Japan International Cooperation Agency		

RE-BAR ARRANGEMENT OF SHAFT B (3) S=1/50

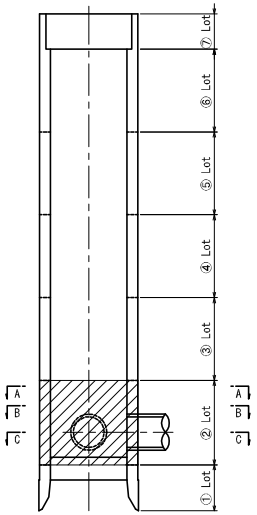
(1ST STEP)



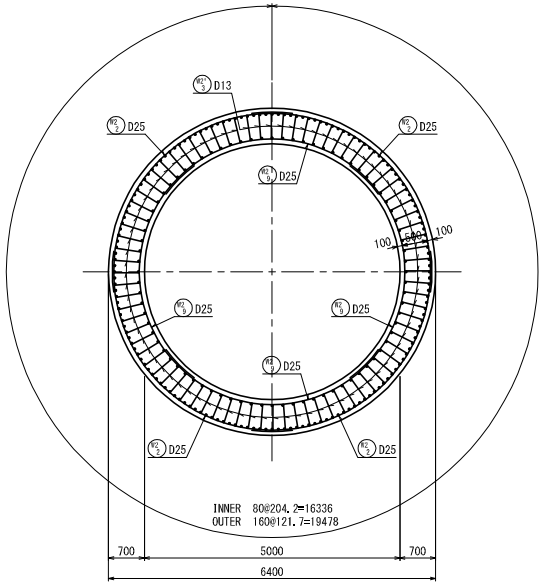
A - A



C - C



KEY PLAN



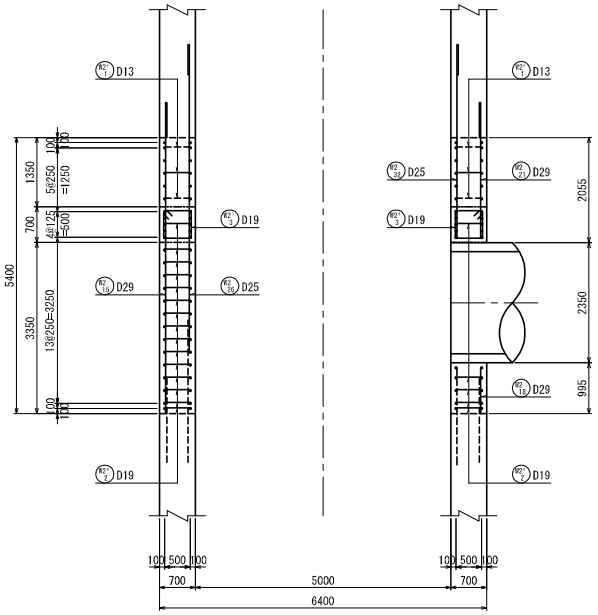
B - B

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (3)		
DRAWING NO:	RB - 03		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT B (4) S=1/50

(1ST STEP)



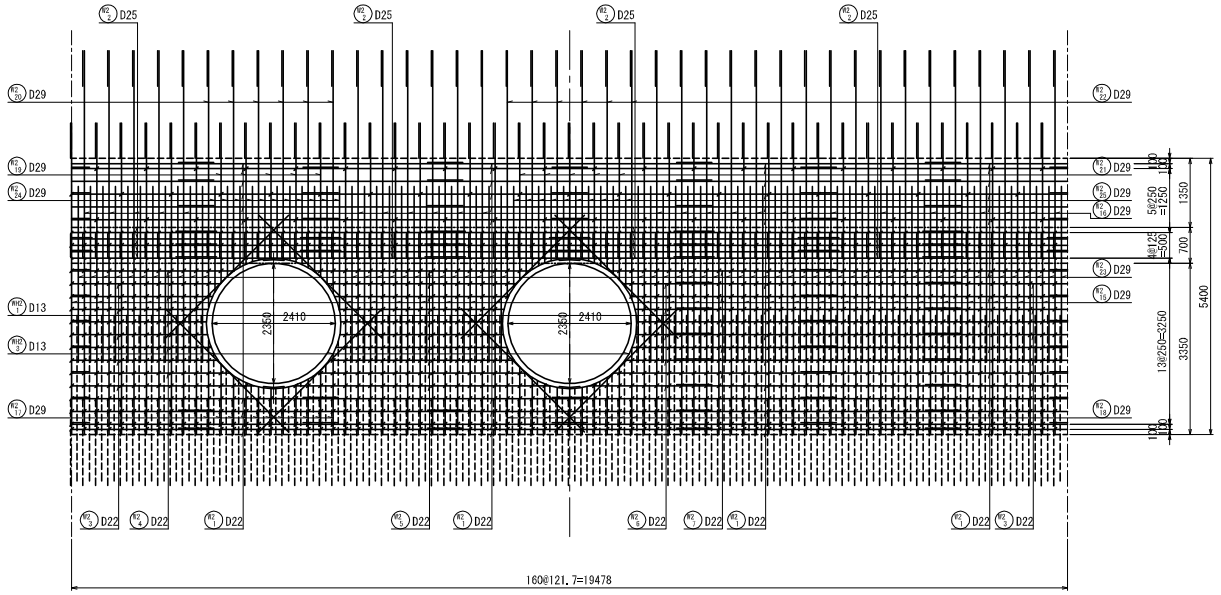
D – D

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (4)		
DRAWING NO:	RB - 04		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT B (5) S=1/50

(1ST STEP)



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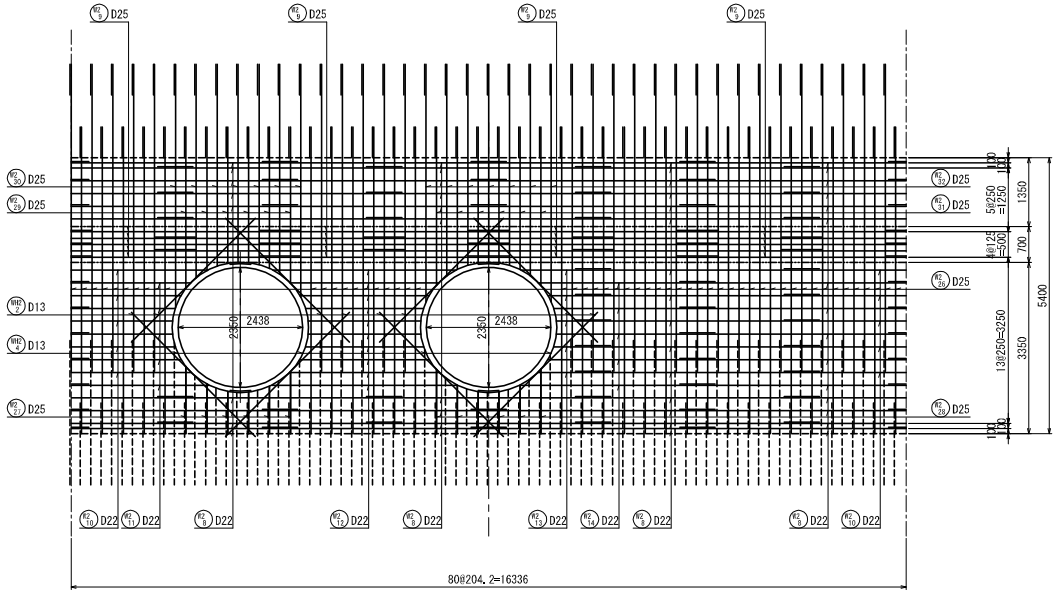


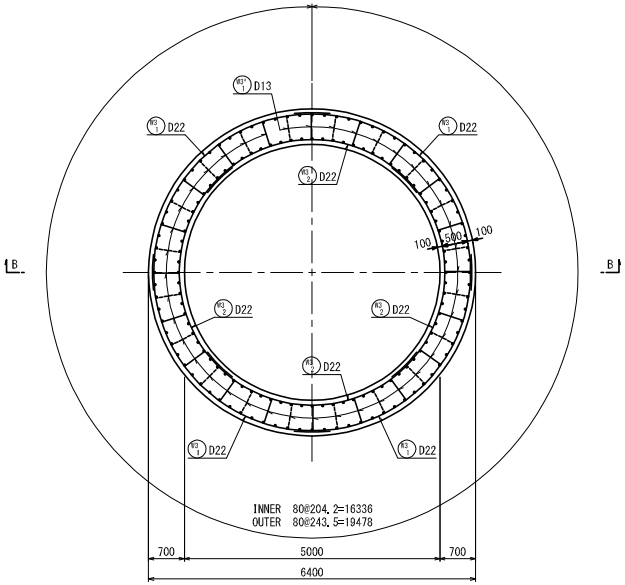
SIDEWALL (INNER)

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (5)
DRAWING NO:	RB - 05
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY
DESIGNED BY:	SHIMAO HIDAKA — DATE:
CHECKED BY:	HARUTOSHI UCHIDA — DATE:

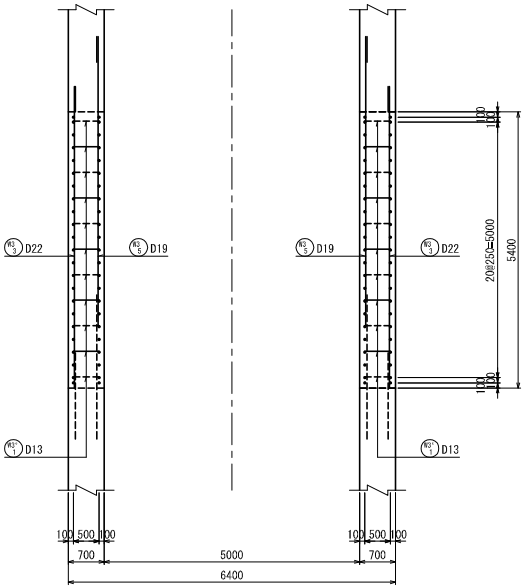
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT B (6) S=1/50

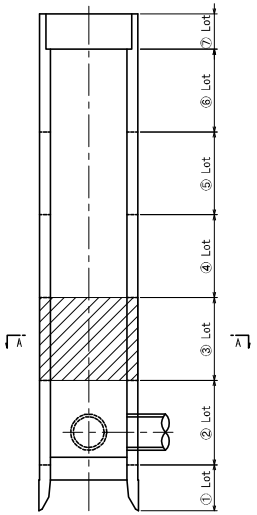
(1ST STEP)



A - A



B - B



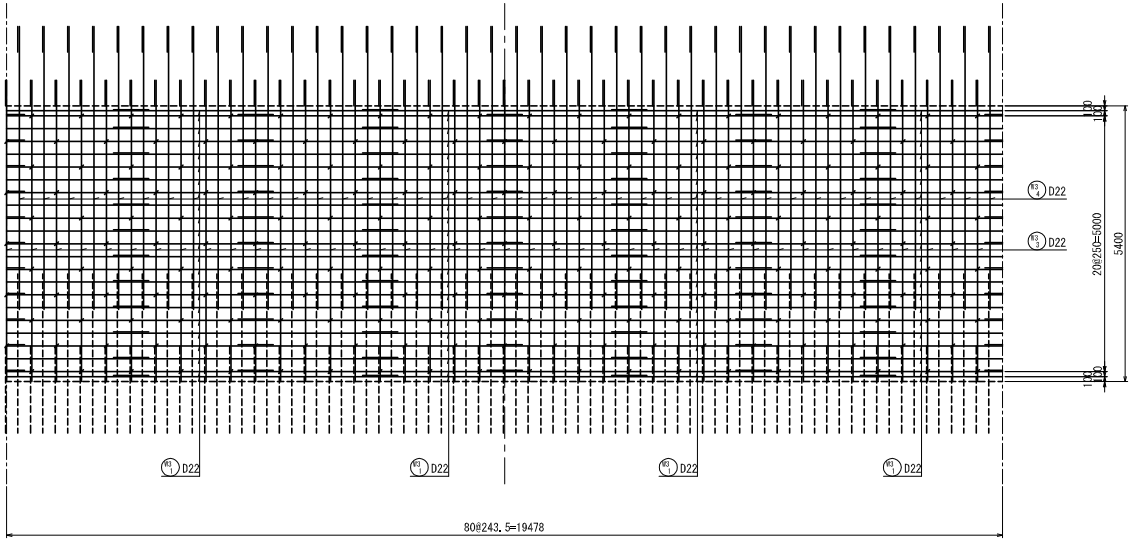
KEY PLAN

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (6)		
DRAWING NO:	RB - 06		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

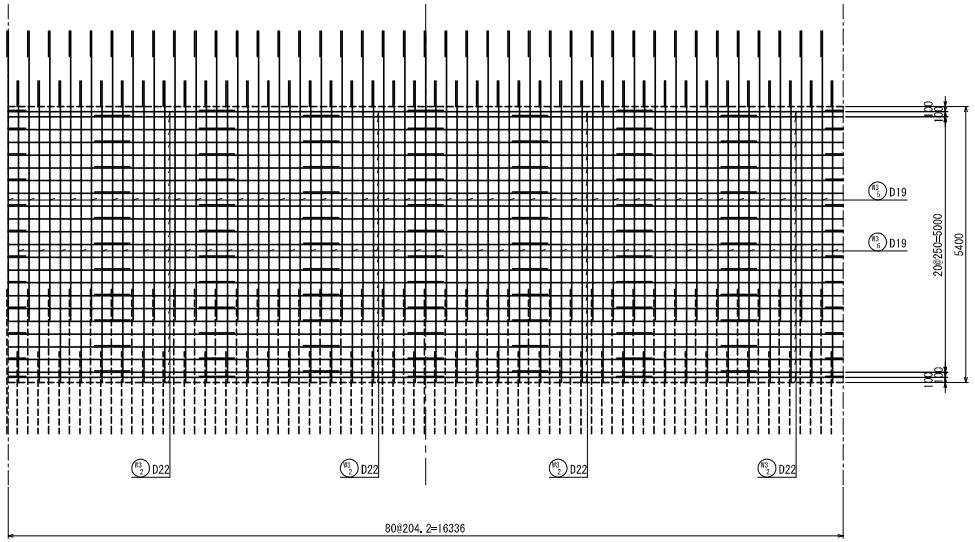
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT B (7) S=1/50

(1ST STEP)



SIDEWALL (OUTER)



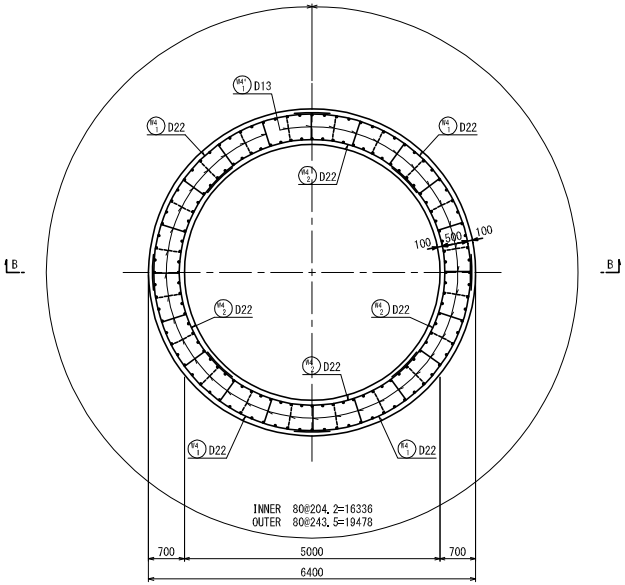
SIDEWALL (INNER)

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (7)		
DRAWING NO:	RB - 07		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

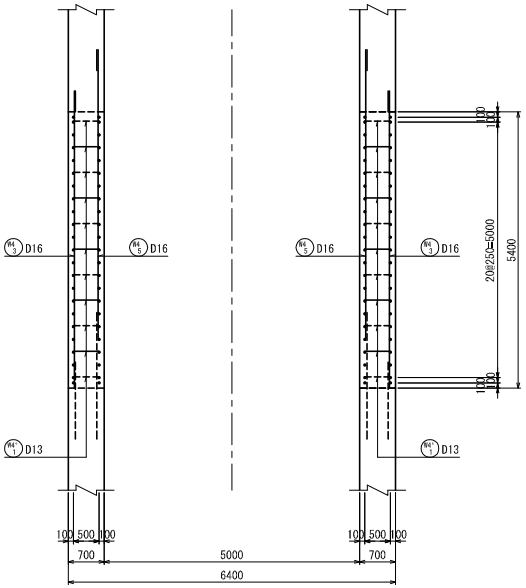
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT B (8) S=1/50

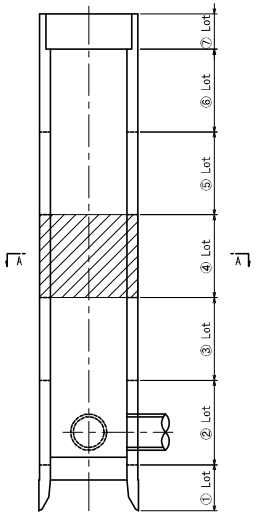
(1ST STEP)



A - A



B - B



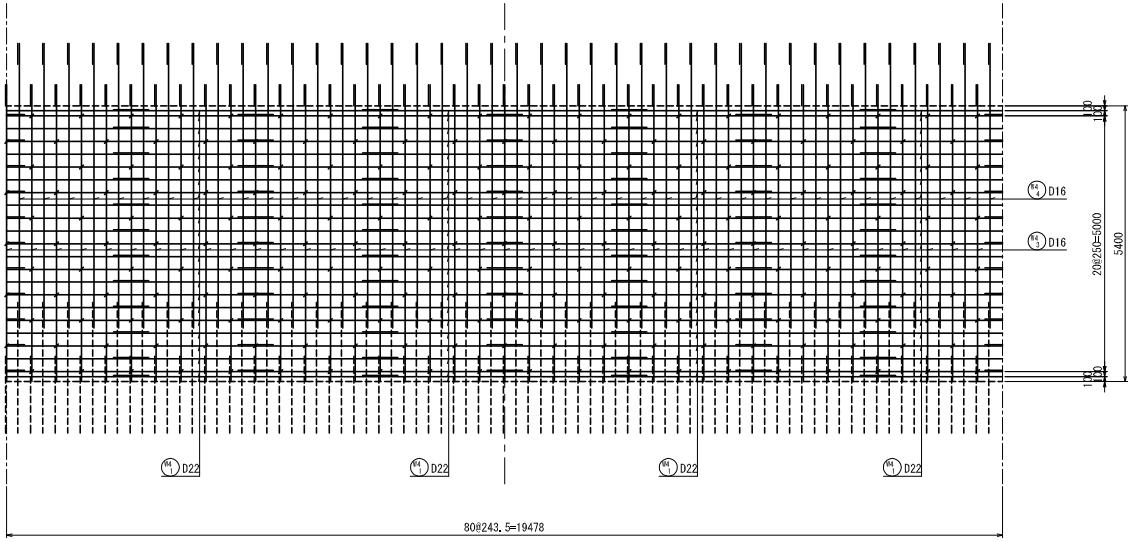
KEY PLAN

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (8)		
DRAWING NO:	RB - 08		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

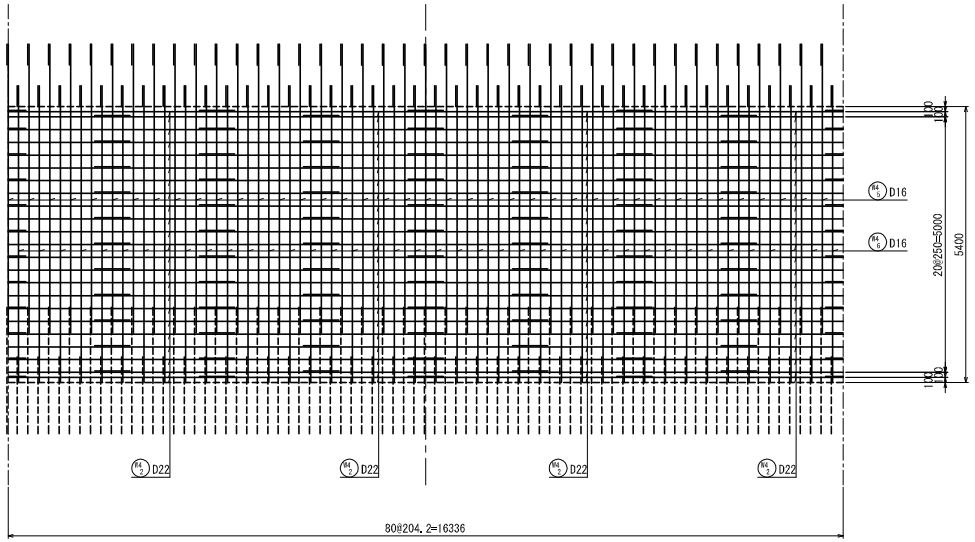
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT B (9) S=1/50

(1ST STEP)



SIDEWALL (OUTER)

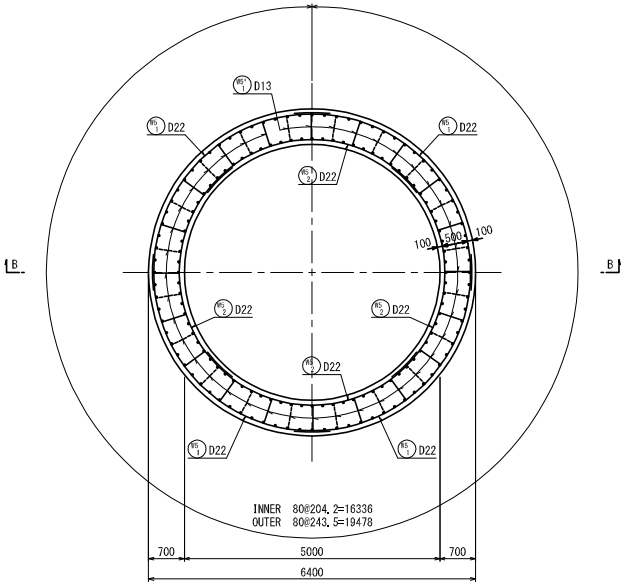


SIDEWALL (INNER)

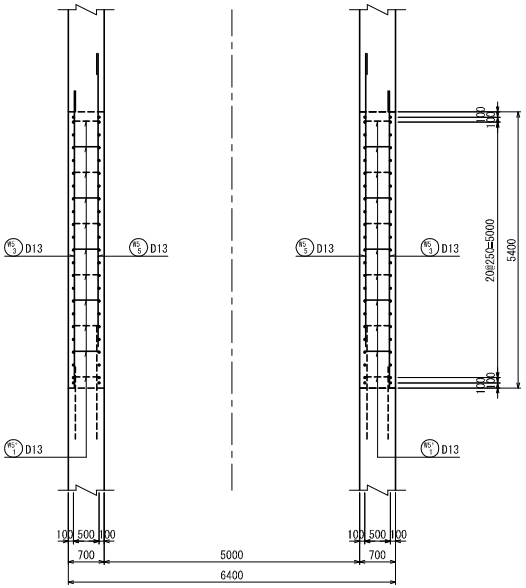
PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (9)		
DRAWING NO:	RB - 09		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	
JICA	Japan International Cooperation Agency		

RE-BAR ARRANGEMENT OF SHAFT B (10) S=1/50

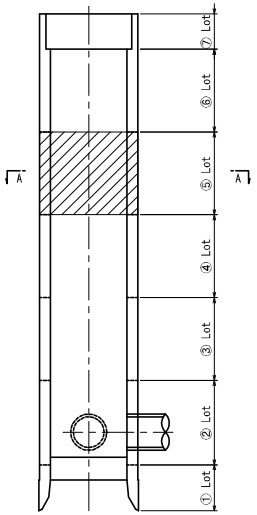
(1ST STEP)



A - A



B - B



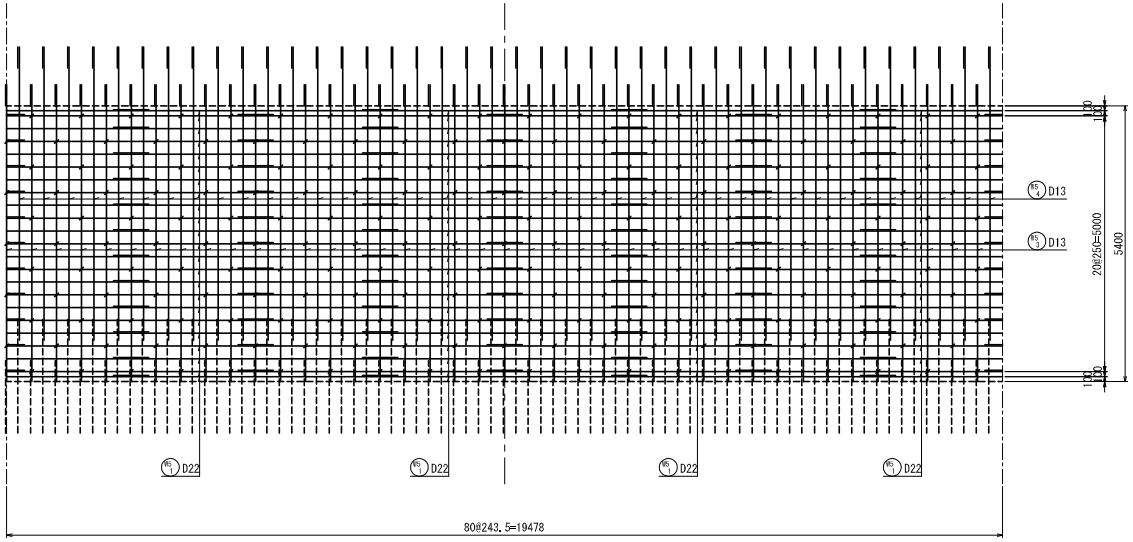
KEY PLAN

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (10)		
DRAWING NO:	RB - 10		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

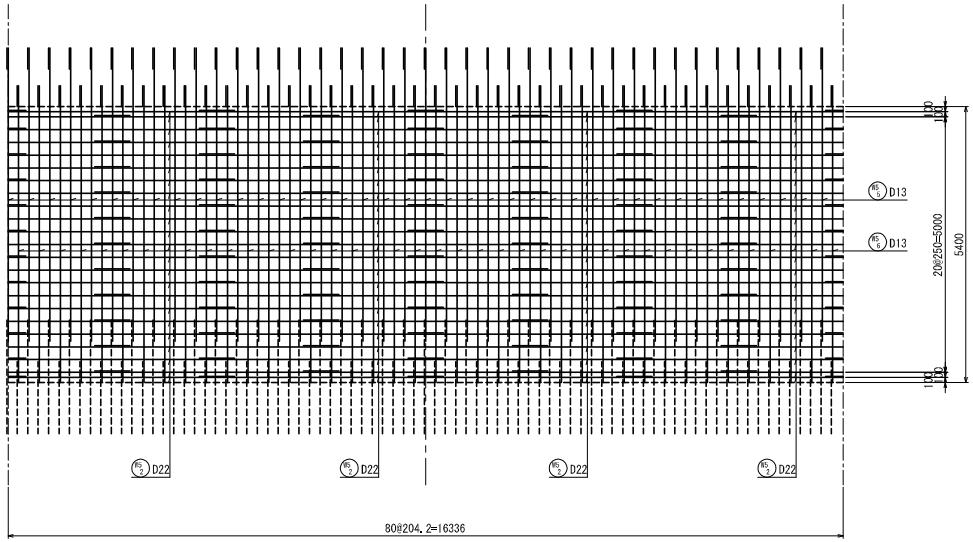
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT B (11) S=1/50

(1ST STEP)



SIDEWALL (OUTER)

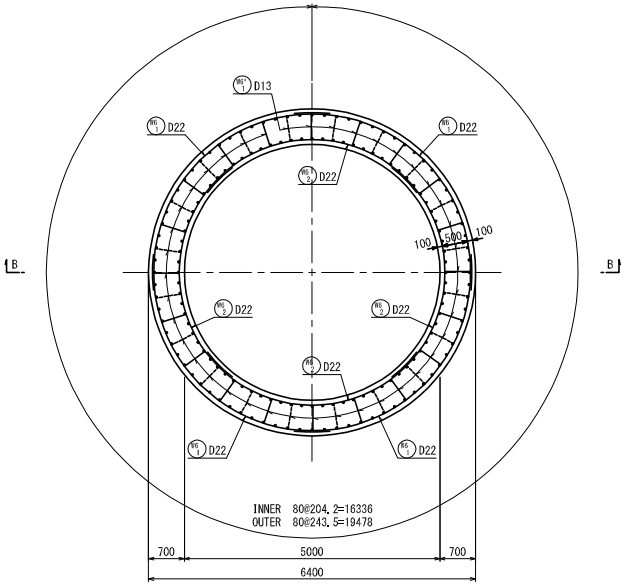


SIDEWALL (INNER)

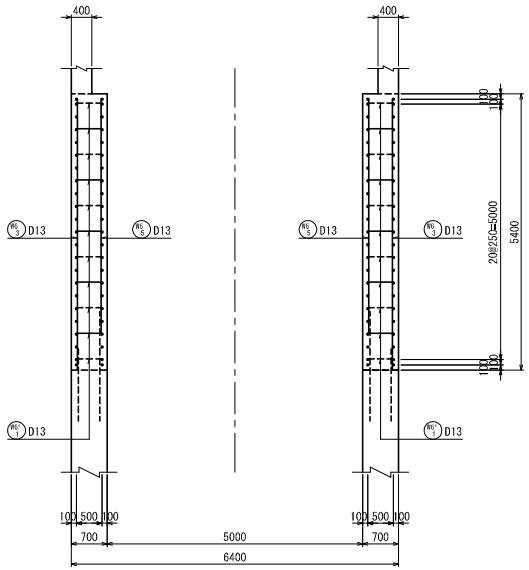
PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (11)		
DRAWING NO:	RB - 11		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	
JICA	Japan International Cooperation Agency		

RE-BAR ARRANGEMENT OF SHAFT B (12) S=1/50

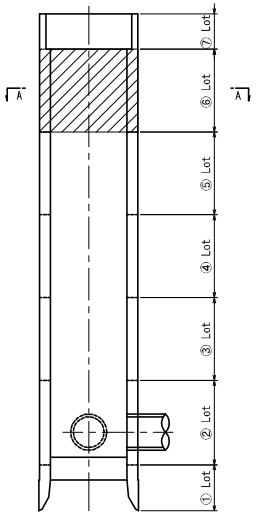
(1ST STEP)



A - A



B - B



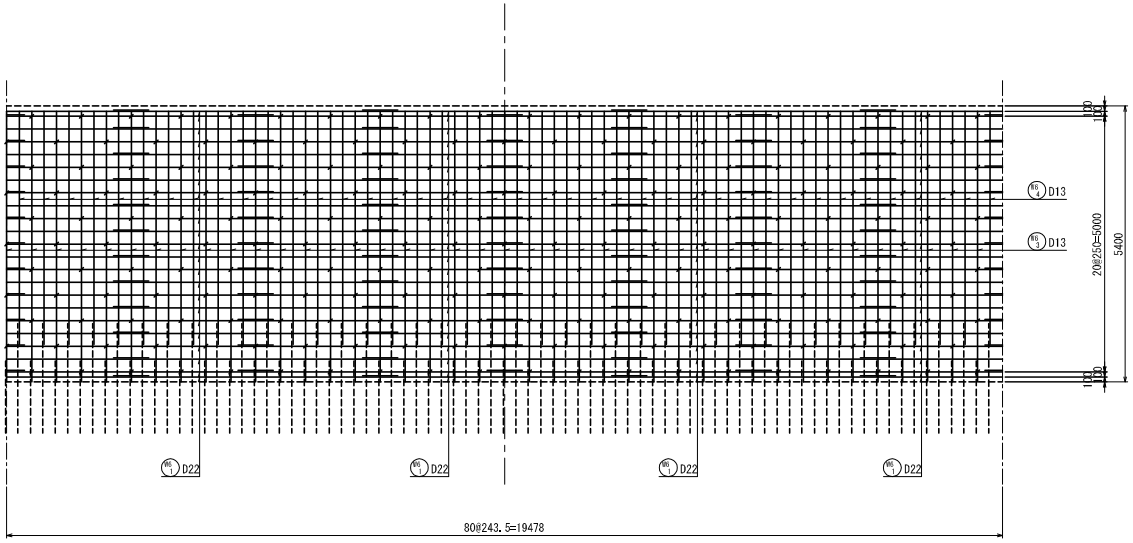
KEY PLAN

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (12)		
DRAWING NO:	RB - 12		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

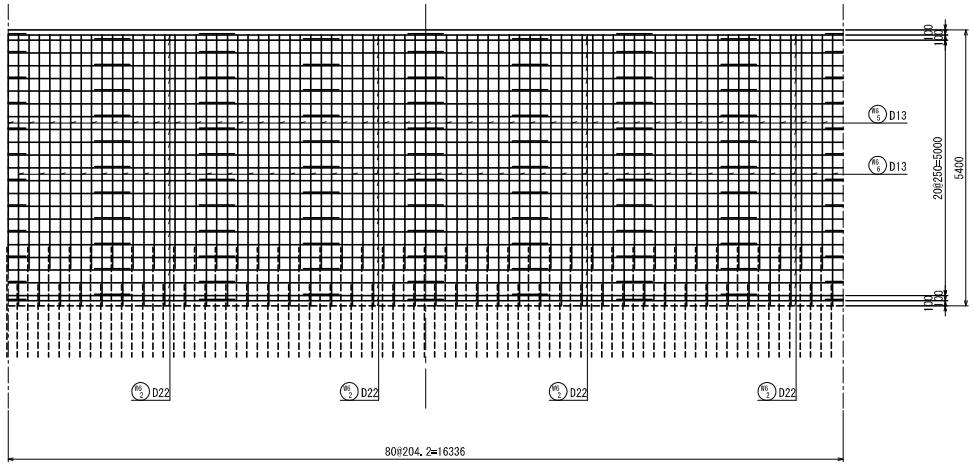
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT B (13) S=1/50

(1ST STEP)



SIDEWALL (OUTER)

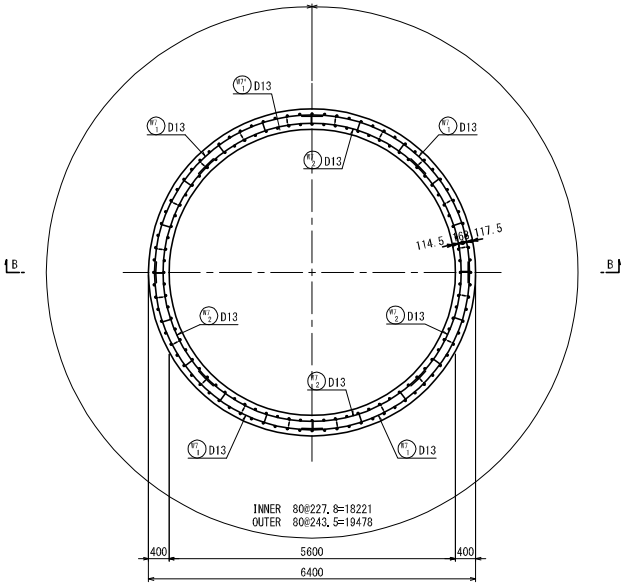


SIDEWALL (INNER)

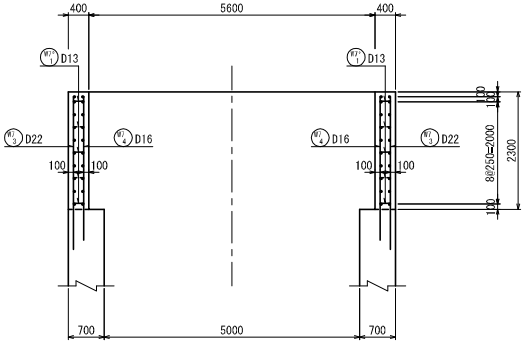
PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (13)		
DRAWING NO:	RB - 13		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	
Japan International Cooperation Agency			

RE-BAR ARRANGEMENT OF SHAFT B (14) S=1/50

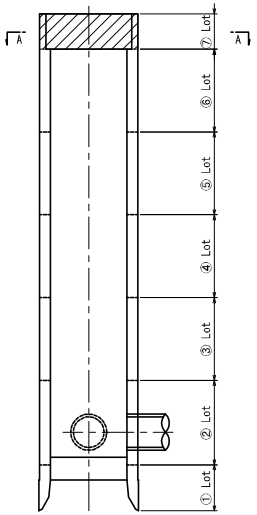
(1ST STEP)



A - A



B - B



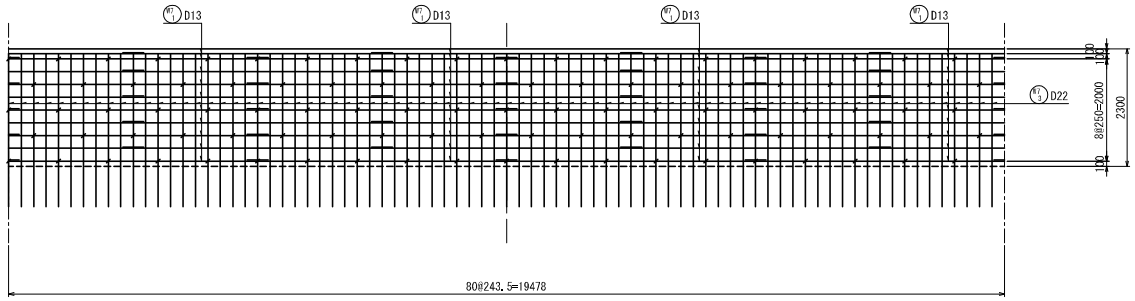
KEY PLAN

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (14)		
DRAWING NO:	RB - 14		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

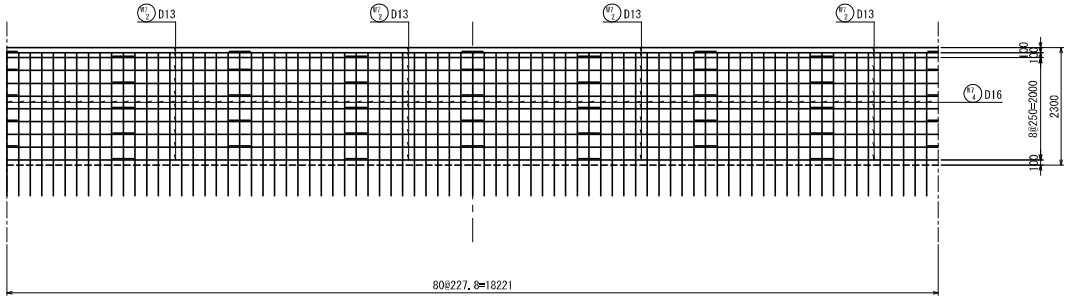
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT B (15) S=1/50

(1ST STEP)



SIDEWALL (OUTER)



SIDEWALL (INNER)

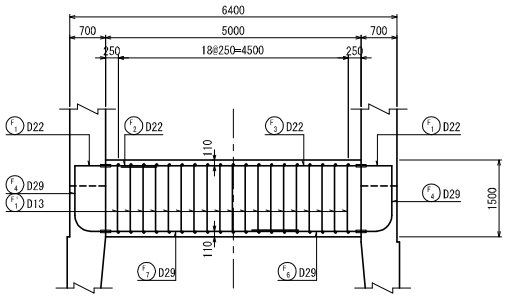
PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (15)		
DRAWING NO:	RB - 15		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	
JICA	Japan International Cooperation Agency		

RE-BAR ARRANGEMENT OF SHAFT B (16) S=1/50

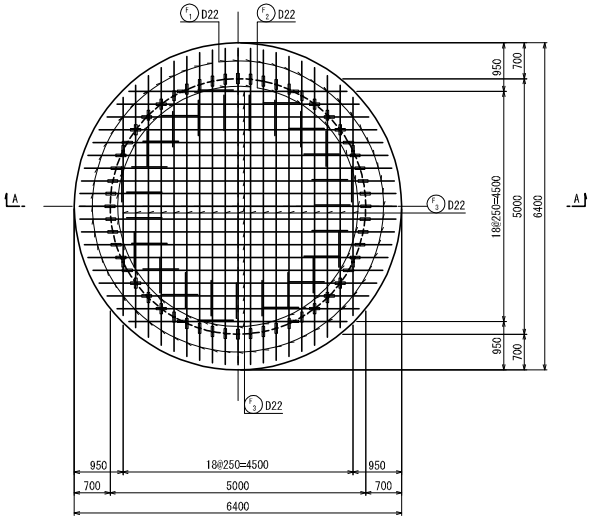
(1ST STEP)

BOTTOM SLAB

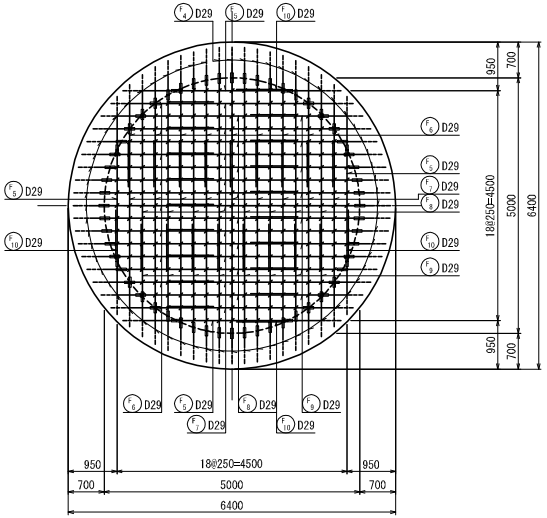
1 - 1



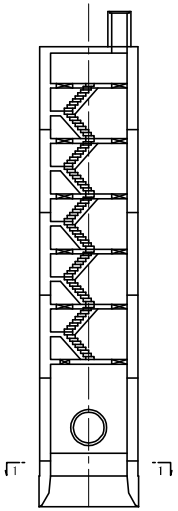
A - A



BOTTOM SLAB (UPPER)



BOTTOM SLAB (LOWER)



KEY PLAN

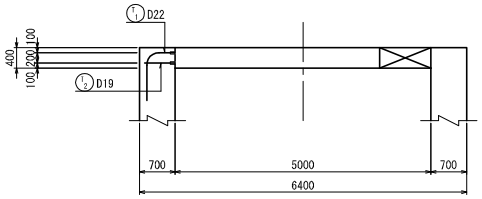
PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (16)		
DRAWING NO:	RB - 16		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT B (17) S=1/50

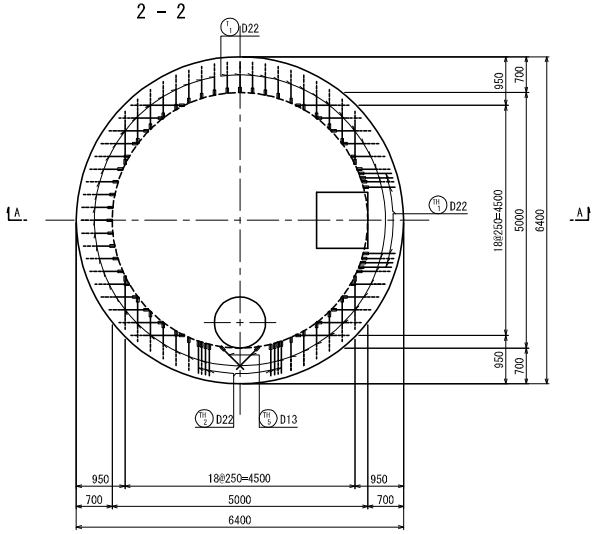
(1ST STEP)

TOP SLAB

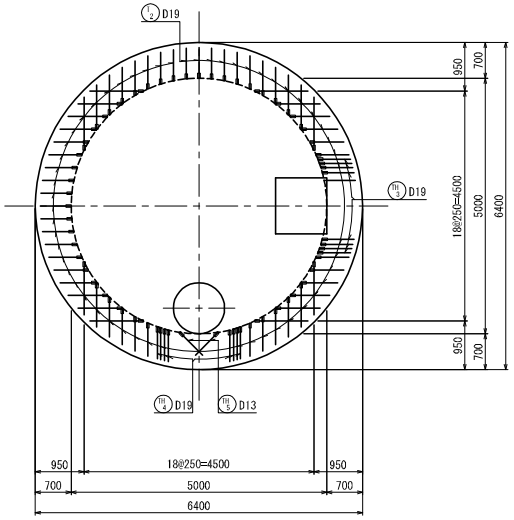


A – A

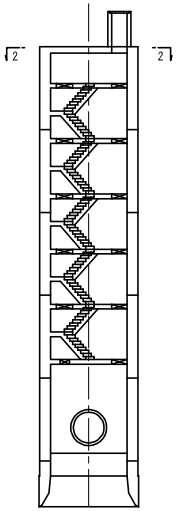
2 – 2



TOP SLAB (UPPER)



TOP SLAB (LOWER)



KEY PLAN

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (17)		
DRAWING NO:	RB - 17		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

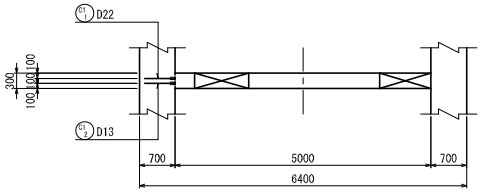
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT B (18) S=1/50

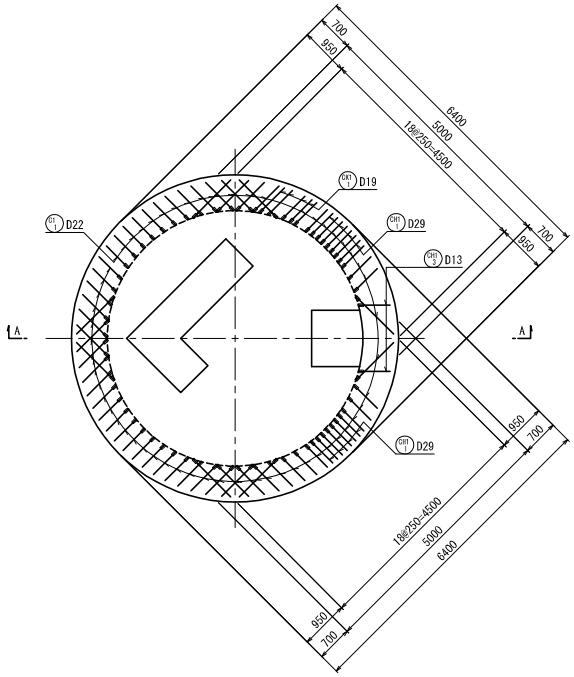
(1ST STEP)

MID SLAB-1

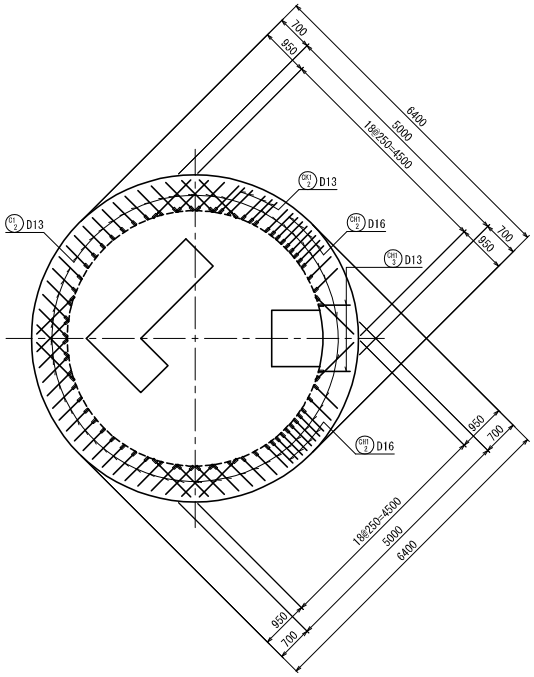
B1F



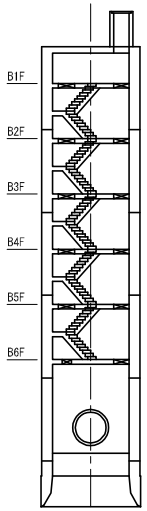
A – A



MID SLAB (UPPER)



MID SLAB (LOWER)



KEY PLAN

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (18)		
DRAWING NO:	RB - 18		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

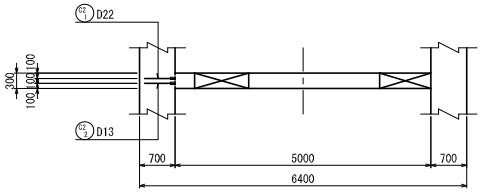
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT B (19) S=1/50

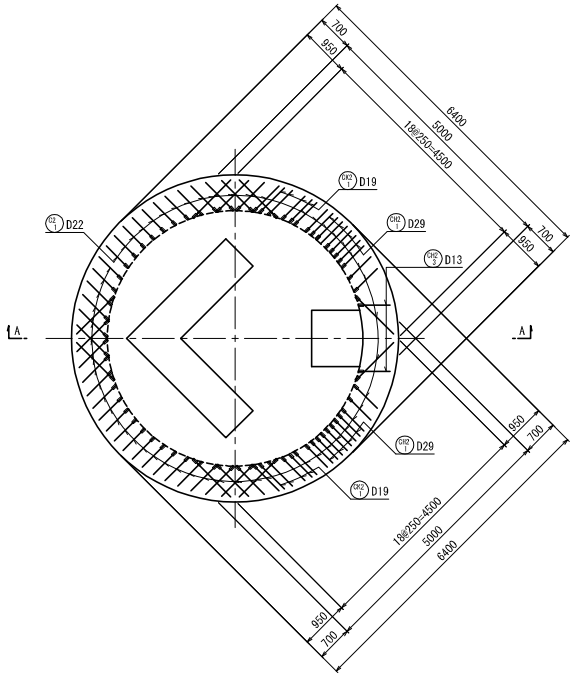
(1ST STEP)

MID SLAB-2

B2F・B3F・B4F・B5F



A – A



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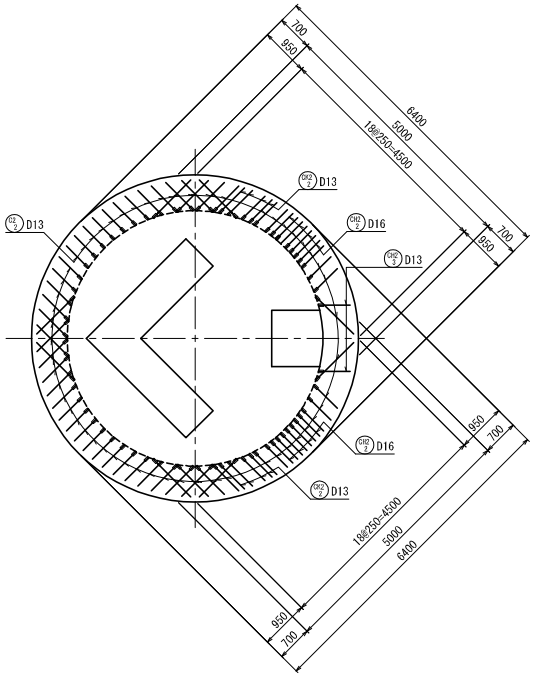

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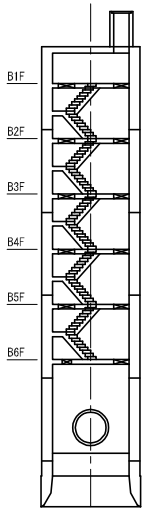


KEY PLAN

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (19)		
DRAWING NO:	RB - 19		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

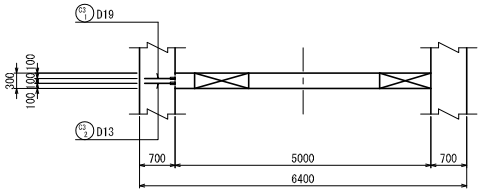
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT B (20) S=1/50

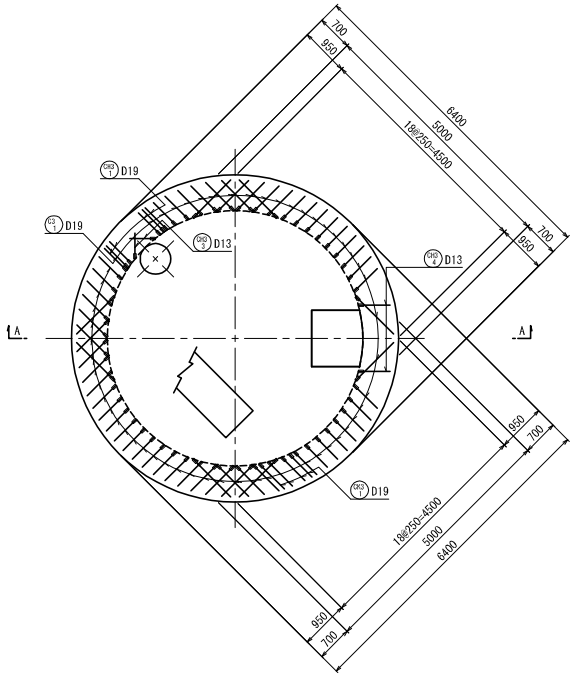
(1ST STEP)

MID SLAB-3

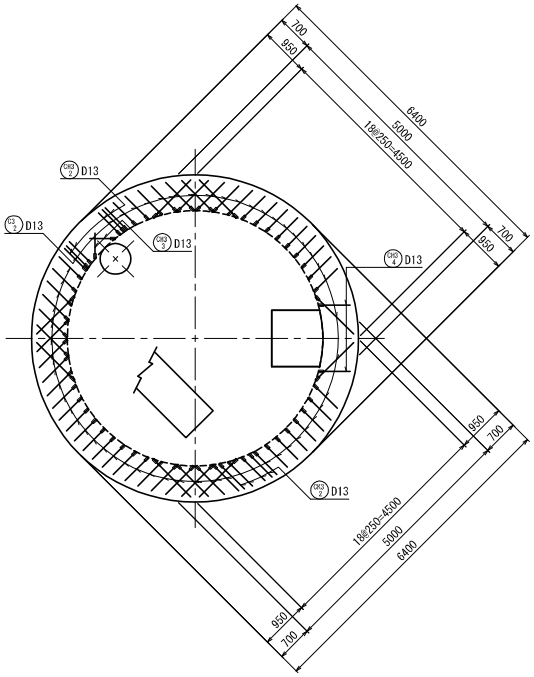
B6F



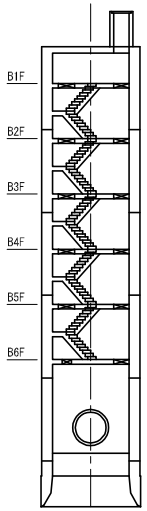
A - A



MID SLAB (UPPER)



MID SLAB (LOWER)



KEY PLAN

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (20)		
DRAWING NO:	RB - 20		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

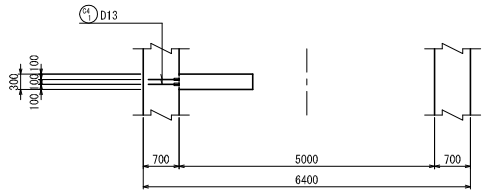
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT B (21) S=1/50

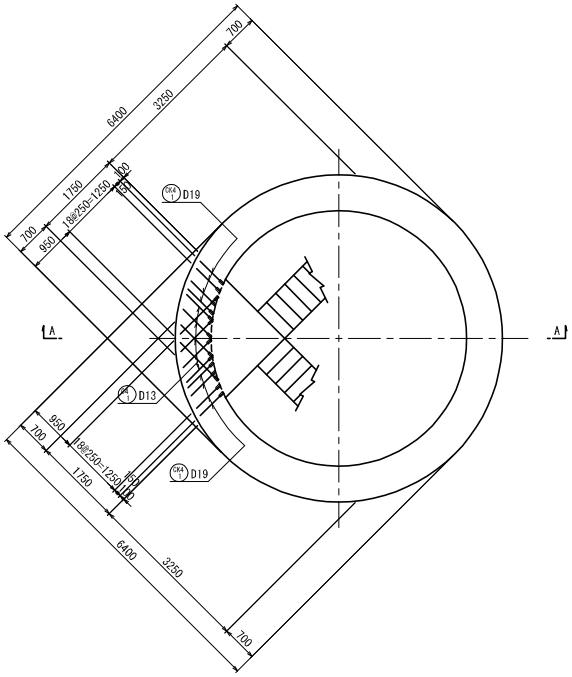
(1ST STEP)

MID SLAB-4

1 - 1



A - A



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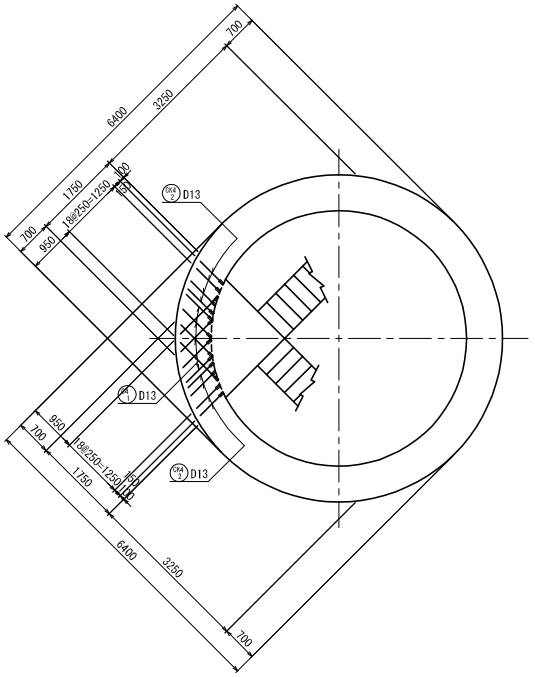
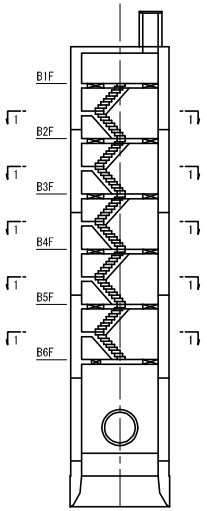


MID SLAB (LOWER)



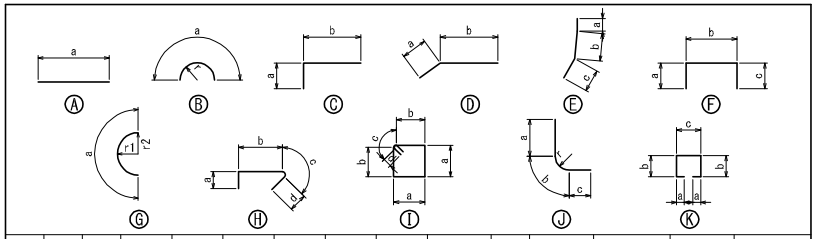
KEY PLAN

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (21)		
DRAWING NO:	RB - 21		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT B (22)

(1ST STEP)



No.	SIZE	TIPE	a	b	c	d	r (r1)	r2	LENGTH (mm)	NUMBER	UNIT WEIGHT	WEIGHT/N	WEIGHT (kg)	REMARK
SIDEWALL : ①LOT														
W1 1	D 22	B	5,559				3,100		5,560	20	3.04	16.90	338	
2	D 13	B	5,331				3,132.5		5,340	28	0.995	5.31	149	
3	D 22	B	4,774				2,600		4,780	16	3.04	14.53	232	
4	D 13	B	5,139 ~4,603				3,010.5 ~2,669.5		4,880	28	0.995	4.86	136	(Av. LENGTH)
5	D 22	A	2,480						2,480	40	3.04	7.54	302	
6	D 22	A	3,895						3,900	28	3.04	11.86	332	
7	D 22	A	2,698 ~3,638						3,170	6	3.04	9.64	58	(Av. LENGTH)
8	D 22	A	2,707 ~3,480						3,100	6	3.04	9.42	57	(Av. LENGTH)
9	D 29	A	3,235						3,240	59	5.04	16.33	963	
10	D 29	A	1,807 ~2,814						2,310	11	5.04	11.64	128	(Av. LENGTH)
11	D 29	A	1,810 ~2,376						2,100	10	5.04	10.58	106	(Av. LENGTH)
12	D 22	C	540	1,738					2,280	80	3.04	6.93	554	
13	D 19	D	600	2,820					3,420	26	2.25	7.70	200	
14	D 19	D	600	1,595					2,200	40	2.25	4.95	198	
15	D 19	D	600	1,801 ~2,691					2,850	7	2.25	6.41	45	(Av. LENGTH)
16	D 19	D	600	1,800 ~2,574					2,790	7	2.25	6.28	44	(Av. LENGTH)
17	D 16	E	500	1,079	866				2,450	80	1.56	3.82	306	
W1' 1	D 13	F	100	535	100				740	40	0.995	0.74	30	
2	D 13	F	100	186 ~527	100				560	60	0.995	0.56	34	

D29	1,197 kg
D22	1,873 kg
D19	487 kg
D16	306 kg
D13	349 kg
TOTAL	4,212 kg

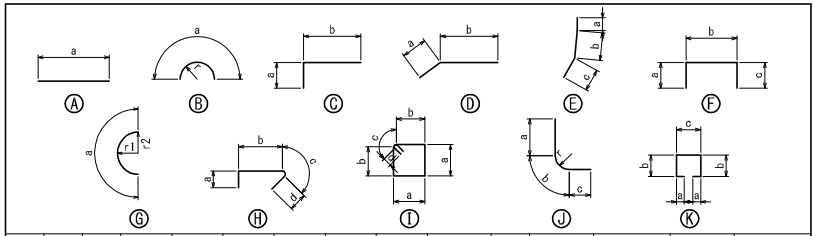
RE-BAR BENDING SCHEDULE

PROJECT :	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE :	RE-BAR ARRANGEMENT OF SHAFT B (22)
DRAWING NO :	RB - 22
CONSULTANTS :	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY
DESIGNED BY :	SHIMAO HIDAKA — DATE :
CHECKED BY :	HARUTOSHI UCHIDA — DATE :

Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT B (23)

(1ST STEP)



No.	SIZE	TIPE	a	b	c	d	r(r1)	r2	LENGTH(mm)	NUMBER	UNIT WEIGHT	WEIGHT/N	WEIGHT(kg)	REMARK
SIDEWALL : ②LOT														
W2 1	D 22	B	5,559				3,100		5,560	50	3.04	16.90	845	
2	D 25	B	5,659				3,100		5,660	20	3.98	22.53	451	
3	D 22	B	5,435 ~8,348				3,100		5,900	5	3.04	17.94	90	(Av.LENGTH)
4	D 22	B	2,981 ~3,520				3,100		3,250	5	3.04	9.88	49	(Av.LENGTH)
5	D 22	B	3,162 ~5,026				3,100		4,100	10	3.04	12.46	125	(Av.LENGTH)
6	D 22	B	1,485 ~2,398				3,100		1,950	5	3.04	5.93	30	(Av.LENGTH)
7	D 22	B	3,901 ~4,440				3,100		4,170	5	3.04	12.68	63	(Av.LENGTH)
8	D 22	B	4,774				2,600		4,780	50	3.04	14.53	727	
9	D 25	B	4,874				2,600		4,880	20	3.98	19.42	388	
10	D 22	B	4,373 ~5,063				2,600		4,720	5	3.04	14.35	72	(Av.LENGTH)
11	D 22	B	2,332 ~3,040				2,600		2,690	5	3.04	8.18	41	(Av.LENGTH)
12	D 22	B	2,202 ~3,621				2,600		2,920	10	3.04	8.88	89	(Av.LENGTH)
13	D 22	B	1,060 ~1,750				2,600		1,410	5	3.04	4.29	21	(Av.LENGTH)
14	D 22	B	3,103 ~3,812				2,600		3,460	5	3.04	10.52	53	(Av.LENGTH)
15	D 29	A	6,090						6,090	30	5.04	30.69	921	
16	D 29	A	7,505						7,510	28	5.04	37.85	1,060	
17	D 29	A	896 ~1,848						1,380	11	5.04	6.96	77	(Av.LENGTH)
18	D 29	A	895 ~1,690						1,300	11	5.04	6.55	72	(Av.LENGTH)
19	D 29	A	2,646 ~3,126						2,890	5	5.04	14.57	73	(Av.LENGTH)
20	D 29	A	4,073 ~5,013						4,550	6	5.04	22.93	138	(Av.LENGTH)
21	D 29	A	2,645 ~3,064						2,860	5	5.04	14.41	72	(Av.LENGTH)
22	D 29	A	4,082 ~4,855						4,470	6	5.04	22.53	135	(Av.LENGTH)
23	D 29	A	3,440						3,440	59	5.04	17.34	1,023	
24	D 29	A	1,412 ~2,432						1,930	11	5.04	9.73	107	(Av.LENGTH)
25	D 29	A	1,416 ~1,985						1,700	10	5.04	8.57	86	(Av.LENGTH)
26	D 25	A	6,000						6,000	54	3.98	23.88	1,290	
27	D 25	A	814 ~1,315						1,070	6	3.98	4.26	26	(Av.LENGTH)
28	D 25	A	820 ~1,261						1,040	6	3.98	4.14	25	(Av.LENGTH)
29	D 25	A	2,654 ~3,155						2,910	6	3.98	11.58	69	(Av.LENGTH)
30	D 25	A	3,871 ~4,761						4,320	7	3.98	17.19	120	(Av.LENGTH)
31	D 25	A	2,660 ~3,101						2,880	6	3.98	11.46	69	(Av.LENGTH)
32	D 25	A	3,870 ~4,644						4,260	7	3.98	16.95	119	(Av.LENGTH)
WH2 1	D 13	A	3,408						3,410	8	0.995	3.39	27	
2	D 13	A	3,426						3,430	8	0.995	3.41	27	
3	D 13	G	4,477				1,275	1,314	4,480	4	0.995	4.46	18	
4	D 13	G	4,506				1,275	1,333	4,510	4	0.995	4.49	18	
W2° 1	D 13	F	100	535	100				740	60	0.995	0.74	44	
2	D 19	H	285	484	134	190	57		1,100	1024	2.25	2.48	2,540	
3	D 19	I	544	487	134	190	57		2,710	80	2.25	6.10	488	

D29	3,764 kg
D25	2,557 kg
D22	2,205 kg
D19	3,028 kg
D13	134 kg
TOTAL	11,688 kg

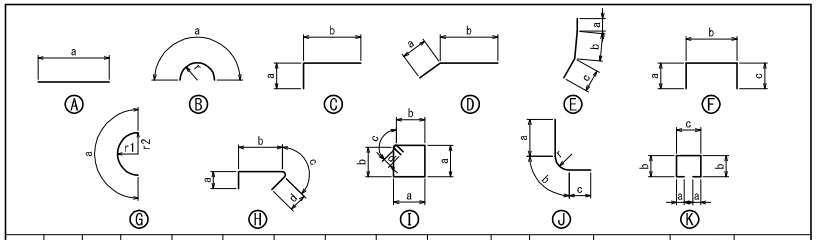
RE-BAR BENDING SCHEDULE

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (23)		
DRAWING NO:	RB - 23		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT B (24)

(1ST STEP)



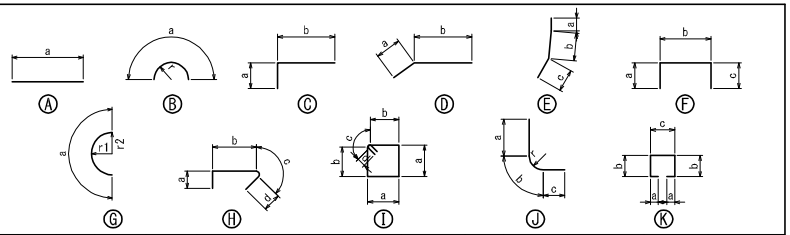
No.	SIZE	TIPE	a	b	c	d	r (r1)	r2	LENGTH (mm)	NUMBER	UNIT WEIGHT	WEIGHT/N	WEIGHT (kg)	REMARK
SIDEWALL : ③LOT														
W3 1	D 22	B	5,559				3,100		5,560	92	3.04	16.90	1,555	
2	D 22	B	4,774				2,600		4,780	92	3.04	14.53	1,337	
3	D 22	A	5,900						5,900	40	3.04	17.94	718	
4	D 22	A	5,535						5,540	40	3.04	16.84	674	
5	D 19	A	5,650						5,650	40	2.25	12.71	508	
6	D 19	A	5,900						5,900	40	2.25	13.28	531	
W3' 1	D 13	F	100	535	100				740	220	0.995	0.74	163	
											D22	4,284 kg		
											D19	1,039 kg		
											D13	163 kg		
											TOTAL	5,486 kg		
SIDEWALL : ④LOT														
W4 1	D 22	B	5,559				3,100		5,560	92	3.04	16.90	1,555	
2	D 22	B	4,774				2,600		4,780	92	3.04	14.53	1,337	
3	D 16	A	5,810						5,810	40	1.56	9.06	362	
4	D 16	A	5,570						5,570	40	1.56	8.69	348	
5	D 16	A	5,645						5,650	40	1.56	8.81	352	
6	D 16	A	5,810						5,810	40	1.56	9.06	362	
W4' 1	D 13	F	100	535	100				740	220	0.995	0.74	163	
											D22	2,892 kg		
											D16	1,424 kg		
											D13	163 kg		
											TOTAL	4,479 kg		
SIDEWALL : ⑤LOT														
W5 1	D 22	B	5,559				3,100		5,560	92	3.04	16.90	1,555	
2	D 22	B	4,774				2,600		4,780	92	3.04	14.53	1,337	
3	D 13	A	5,810						5,810	40	0.995	5.78	231	
4	D 13	A	5,735						5,740	40	0.995	5.71	228	
5	D 13	A	5,735						5,740	40	0.995	5.71	228	
6	D 13	A	5,810						5,810	40	0.995	5.78	231	
W5' 1	D 13	F	100	535	100				740	220	0.995	0.74	163	
											D22	2,892 kg		
											D13	1,081 kg		
											TOTAL	3,973 kg		

RE-BAR BENDING SCHEDULE

PROJECT :	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE :	RE-BAR ARRANGEMENT OF SHAFT B (24)		
DRAWING NO :	RB - 24		
CONSULTANTS :	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY :	SHIMAO HIDAKA	DATE :	
CHECKED BY :	HARUTOSHI UCHIDA	DATE :	
Japan International Cooperation Agency			

RE-BAR ARRANGEMENT OF SHAFT B (25)

(1ST STEP)



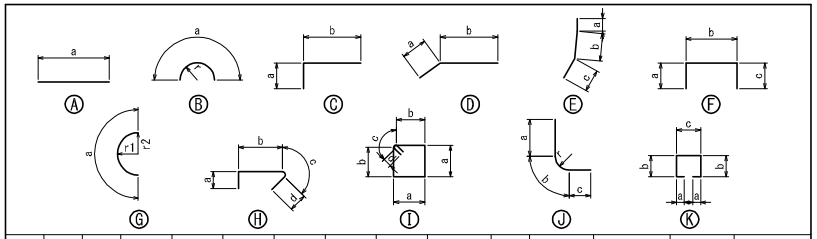
No.	SIZE	TIPE	a	b	c	d	r(r1)	r2	LENGTH(mm)	NUMBER	UNIT WEIGHT	WEIGHT/N	WEIGHT(kg)	REMARK
SIDEWALL : ⑥LOT														
W6 1	D 22	B	5,559				3,100		5,560	92	3.04	16.90	1,555	
2	D 22	B	4,774				2,600		4,780	92	3.04	14.53	1,337	
3	D 13	A	5,300						5,300	40	0.995	5.27	211	
4	D 13	A	4,565						4,570	40	0.995	4.55	182	
5	D 13	A	4,565						4,570	40	0.995	4.55	182	
6	D 13	A	5,300						5,300	40	0.995	5.27	211	
W6' 1	D 13	F	100	535	100				740	220	0.995	0.74	163	
											D22	2,892 kg		
											D13	949 kg		
											TOTAL	3,841 kg		
BOTTOM SLAB														
F 1	D 22	A	600 ~1,043						830	76	3.04	2.52	192	(M.S.)
2	D 22	A	1,000						1,000	38	3.04	3.04	116	(M.S.)
3	D 22	A	1,869 ~4,690						3,280	38	3.04	9.97	379	(Av.LENGTH) (M.S.)
4	D 29	J	970	487	290 ~733		310		1,970	76	5.04	9.93	755	(Av.LENGTH) (M.S.)
5	D 29	A	2,089						2,090	4	5.04	10.53	42	(M.S.)
6	D 29	A	1,127 ~2,138						1,640	18	5.04	8.27	149	(Av.LENGTH) (M.S.)
7	D 29	A	2,773 ~3,773						3,280	18	5.04	16.53	298	(Av.LENGTH) (M.S.)
8	D 29	A	3,058 ~3,760						3,410	16	5.04	17.19	275	(Av.LENGTH) (M.S.)
9	D 29	A	1,423 ~2,125						1,780	16	5.04	8.97	144	(Av.LENGTH) (M.S.)
10	D 29	A	1,000						1,000	4	5.04	5.04	20	(M.S.)
F' 1	D 13	H	195	1,280	92	130	39		1,700	305	0.995	1.69	515	
									MECHANICAL SPLICE(M.S.) NEMBER		D29 152 UNIT	D29	1,683 kg	
											D22 152 UNIT	D22	687 kg	
												D13	515 kg	
												TOTAL	2,885 kg	
TOP SLAB														
T 1	D 22	J	690	377	360 ~803		240		1,650	66	3.04	5.02	331	(Av.LENGTH) (M.S.)
2	D 19	A	600 ~1,043						830	66	2.25	1.87	123	(Av.LENGTH) (M.S.)
TH 1	D 22	C	330	617 ~635					960	6	3.04	2.92	18	(Av.LENGTH) (M.S.)
2	D 22	C	330	614 ~627					950	6	3.04	2.89	17	(Av.LENGTH) (M.S.)
3	D 19	C	285	617 ~635					920	6	2.25	2.07	12	(Av.LENGTH) (M.S.)
4	D 19	C	285	614 ~627					910	6	2.25	2.05	12	(Av.LENGTH) (M.S.)
5	D 13	A	633						640	4	0.995	0.64	3	
									MECHANICAL SPLICE(M.S.) NEMBER		D22 78 UNIT	D22	366 kg	
											D19 78 UNIT	D19	147 kg	
												D13	3 kg	
												TOTAL	516 kg	

RE-BAR BENDING SCHEDULE

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (25)		
DRAWING NO:	RB - 25		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	
Japan International Cooperation Agency			

RE-BAR ARRANGEMENT OF SHAFT B (26)

(1ST STEP)



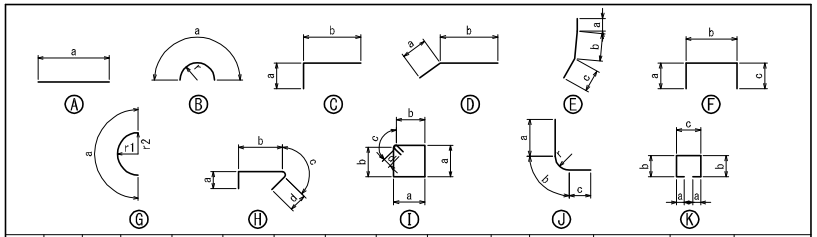
No.	SIZE	TIPE	a	b	c	d	r(r1)	r2	LENGTH(mm)	NUMBER	UNIT WEIGHT	WEIGHT/N	WEIGHT(kg)	REMARK
MID SLAB-1 (B1F)														
C1 1	D 22	A	600 ~1,043						830	66	3.04	2.52	166	(Av.LENGTH) (M.S.)
2	D 13	A	600 ~1,043						830	66	0.995	0.83	55	(Av.LENGTH) (M.S.)
CH1 1	D 29	C	435	601 ~606					1,040	8	5.04	5.24	42	(Av.LENGTH) (M.S.)
2	D 16	A	601 ~606						610	8	1.56	0.95	8	(Av.LENGTH) (M.S.)
3	D 13	A	617						620	4	0.995	0.62	2	(M.S.)
CK1 1	D 19	A	630 ~695						670	4	2.25	1.51	6	(Av.LENGTH) (M.S.)
2	D 13	A	630 ~695						670	4	0.995	0.67	3	(Av.LENGTH) (M.S.)
MECHANICAL SPLICE(M.S.) NEMBER									D29	8 UNIT	D29	42 kg		
									D22	66 UNIT	D22	166 kg		
									D19	4 UNIT	D19	6 kg		
									D16	8 UNIT	D16	8 kg		
									D13	74 UNIT	D13	60 kg		
											TOTAL	282 kg		
MID SLAB-2:PER ONEUNIT (B2F~B5F)														
C2 1	D 22	A	600 ~1,043						830	64	3.04	2.52	161	(Av.LENGTH) (M.S.)
2	D 13	A	600 ~1,043						830	64	0.995	0.83	53	(Av.LENGTH) (M.S.)
CH2 1	D 29	C	435	601 ~606					1,040	8	5.04	5.24	42	(Av.LENGTH) (M.S.)
2	D 16	A	601 ~606						610	8	1.56	0.95	8	(Av.LENGTH) (M.S.)
3	D 13	A	617						620	4	0.995	0.62	2	(M.S.)
CK2 1	D 19	A	630 ~695						670	8	2.25	1.51	12	(Av.LENGTH) (M.S.)
2	D 13	A	630 ~695						670	8	0.995	0.67	5	(Av.LENGTH) (M.S.)
MECHANICAL SPLICE(M.S.) NEMBER									D29	8 UNIT	D29	42 kg		
									D22	64 UNIT	D22	161 kg		
									D19	8 UNIT	D19	12 kg		
									D16	8 UNIT	D16	8 kg		
									D13	76 UNIT	D13	60 kg		
											TOTAL	283 kg		

RE-BAR BENDING SCHEDULE

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (26)		
DRAWING NO:	RB - 26		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	
JICA	Japan International Cooperation Agency		

RE-BAR ARRANGEMENT OF SHAFT B (27)

(1ST STEP)



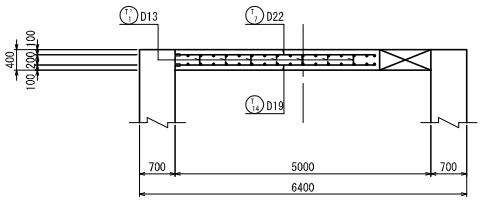
No.	SIZE	TIPE	a	b	c	d	r(r1)	r2	LENGTH(mm)	NUMBER	UNIT WEIGHT	WEIGHT/N	WEIGHT(kg)	REMARK
MID SLAB-3 (B6F)														
C3 1	D 22	A	600 ~1,043						830	65	3.04	2.52	164	(Av.LENGTH) (M.S.)
2	D 13	A	600 ~1,043						830	65	0.995	0.83	54	(Av.LENGTH) (M.S.)
CH3 1	D 19	C	285	606 ~613					900	4	2.25	2.03	8	(Av.LENGTH) (M.S.)
2	D 13	A	606 ~613						610	4	0.995	0.61	2	(Av.LENGTH) (M.S.)
3	D 13	A	498						500	4	0.995	0.50	2	(M.S.)
4	D 13	A	617						620	4	0.995	0.62	2	(M.S.)
CK3 1	D 19	A	630 ~695						670	4	2.25	1.51	6	(Av.LENGTH) (M.S.)
2	D 13	A	630 ~695						670	4	0.995	0.67	3	(Av.LENGTH) (M.S.)
MECHANICAL SPLICE(M.S.) NEMBER									D22 65 UNIT		D22	164 kg		
									D19 8 UNIT		D19	14 kg		
									D13 81 UNIT		D13	63 kg		
											TOTAL	241 kg		
MID SLAB-4:PER ONEUNIT (5UNIT)														
C4 1	D 13	A	713 ~1,043						880	16	0.995	0.88	14	(Av.LENGTH) (M.S.)
1	D 19	A	630 ~695						670	8	2.25	1.51	12	(Av.LENGTH) (M.S.)
CK4 2	D 13	A	630 ~695						670	8	0.995	0.67	5	(Av.LENGTH) (M.S.)
MECHANICAL SPLICE(M.S.) NEMBER									D19 8 UNIT		D19	12 kg		
									D13 24 UNIT		D13	19 kg		
											TOTAL	31 kg		
TOTAL NUMBER OF MECHANICAL SPLICE											TOTAL WEIGHT OF RE-BAR			
									D29 192 UNIT		D29	6,854 kg		
									D25 0 UNIT		D25	2,557 kg		
									D22 617 UNIT		D22	19,792 kg		
									D19 162 UNIT		D19	4,829 kg		
									D16 40 UNIT		D16	2,120 kg		
									D13 579 UNIT		D13	4,267 kg		
									TOTAL 1,590 UNIT		TOTAL	40,419 kg		

RE-BAR BENDING SCHEDULE

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (27)
DRAWING NO:	RB - 27
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY
DESIGNED BY:	SHIMAO HIDAKA — DATE:
CHECKED BY:	HARUTOSHI UCHIDA — DATE:
	Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT B (28) S=1/50

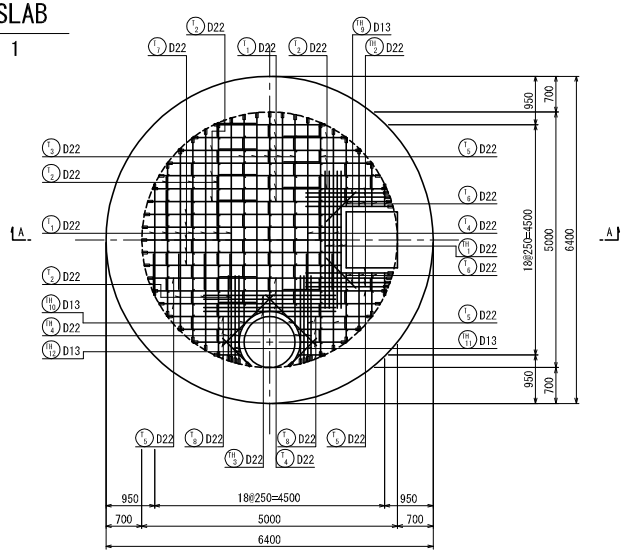
(2ND STEP)



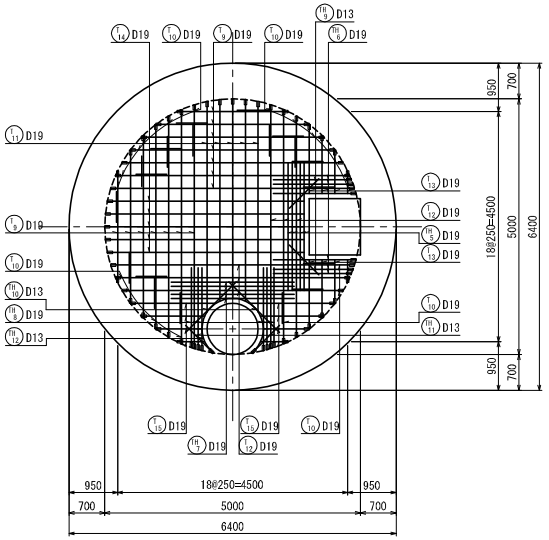
A – A

TOP SLAB

1 – 1

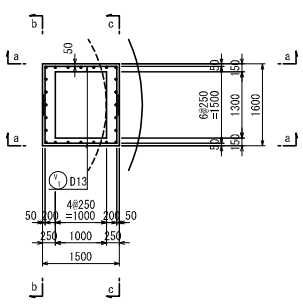


TOP SLAB (UPPER)

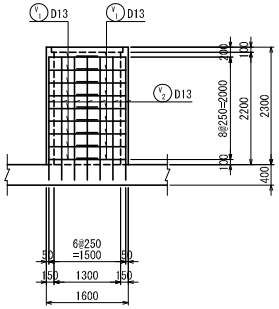


TOP SLAB (LOWER)

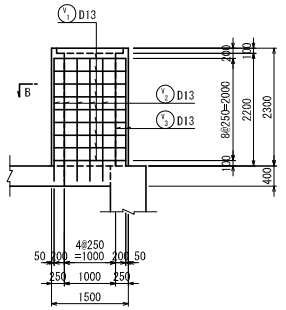
VERTICAL WALL



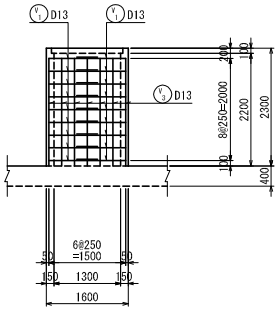
B – B



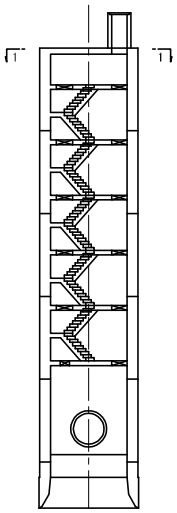
b – b



a – a



c – c



KEY PLAN

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (28)
DRAWING NO:	RB - 28
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY
DESIGNED BY:	SHIMAO HIDAKA — DATE:
CHECKED BY:	HARUTOSHI UCHIDA — DATE:

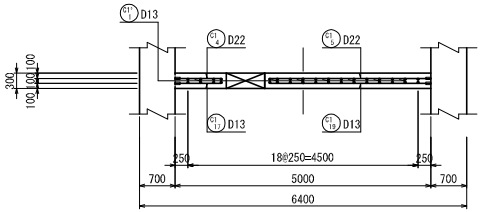
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT B (29) S=1/50

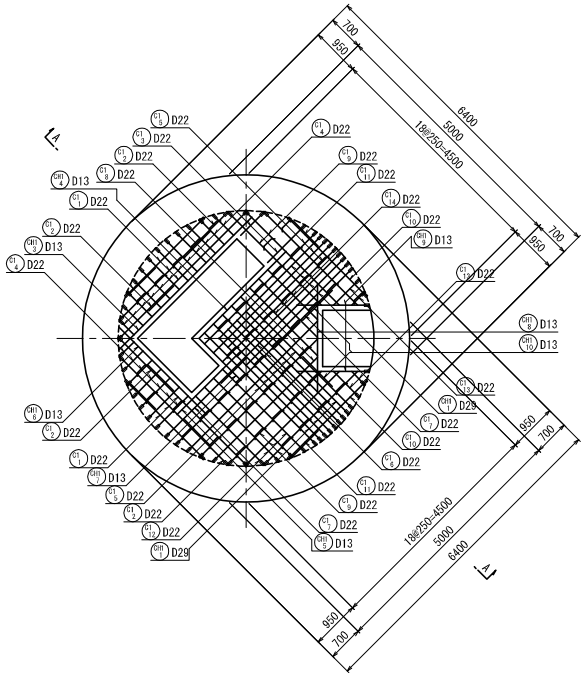
(2ND STEP)

MID SLAB-1

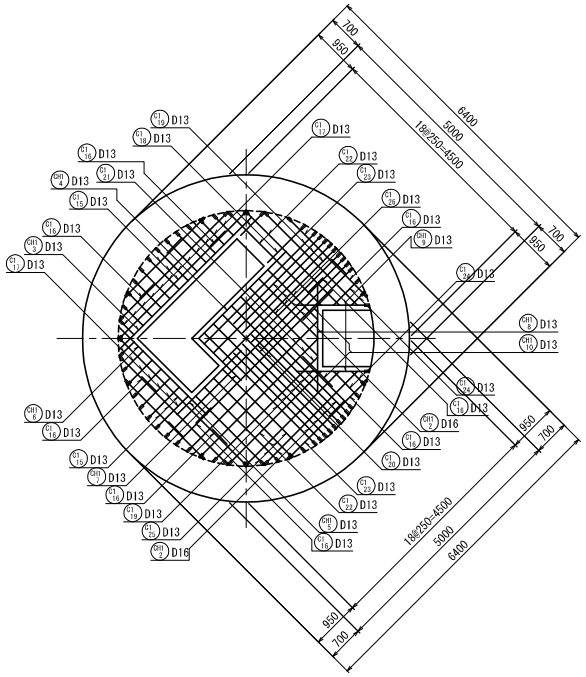
B1F



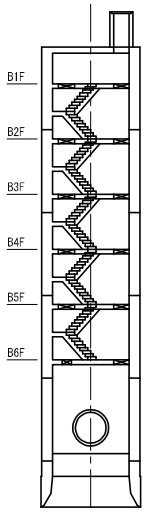
A - A



MID SLAB(UPPER)



MID SLAB(LOWER)



KEY PLAN

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (29)		
DRAWING NO:	RB - 29		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

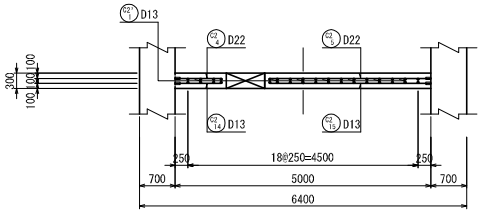
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT B (30) S=1/50

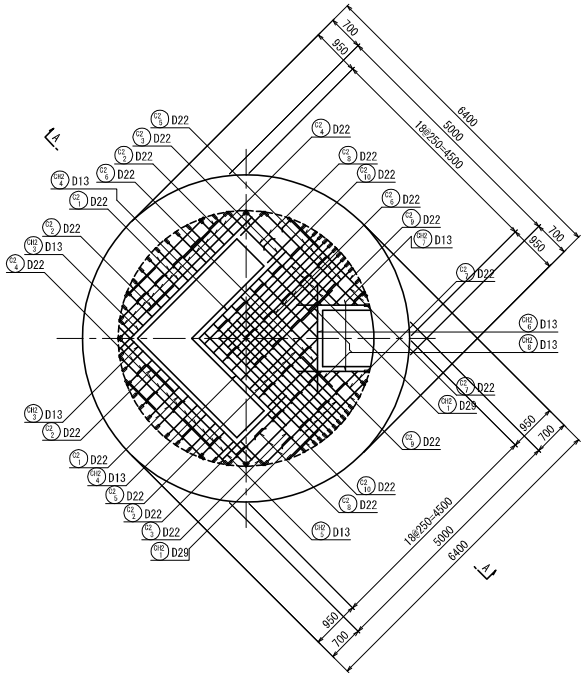
(2ND STEP)

MID SLAB-2

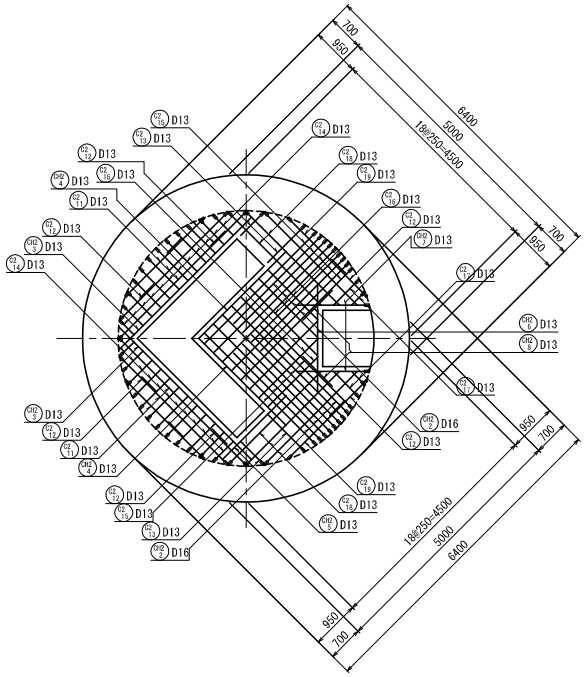
B2F・B3F・B4F・B5F



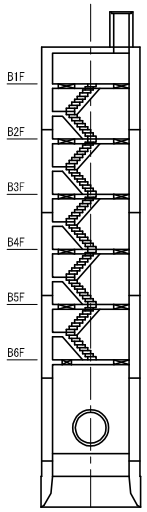
A - A



MID SLAB(UPPER)



MID SLAB(LOWER)



KEY PLAN

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (30)		
DRAWING NO:	RB - 30		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

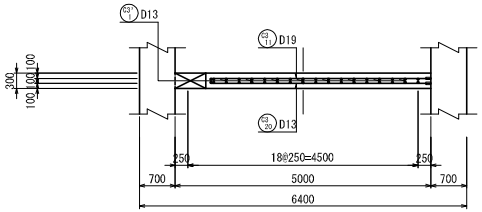
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT B (31) S=1/50

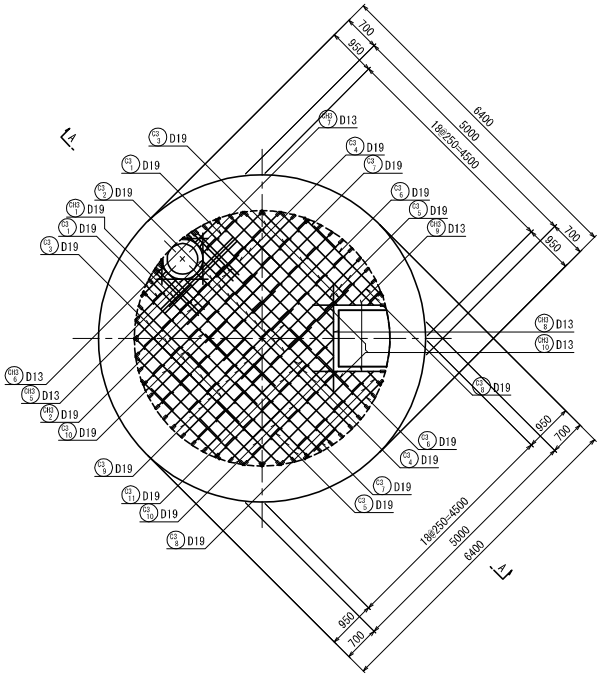
(2ND STEP)

MID SLAB-3

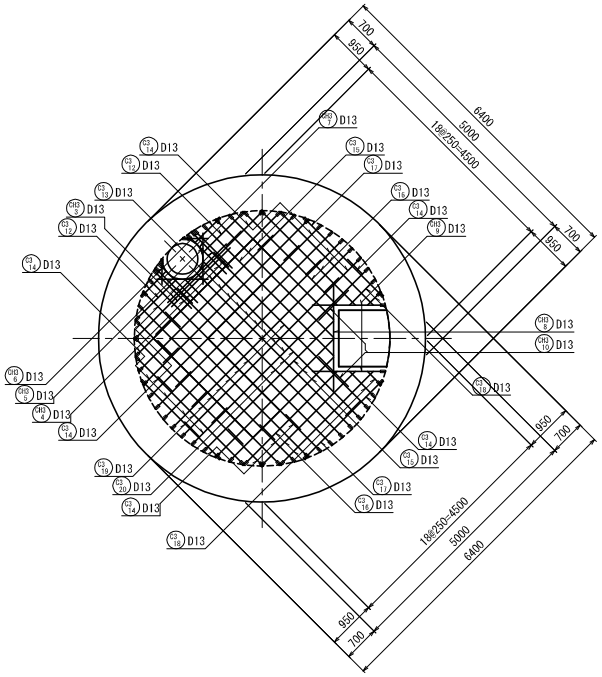
B6F



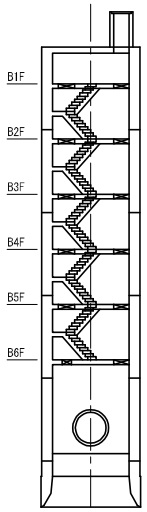
A - A



MID SLAB(UPPER)



MID SLAB(LOWER)



KEY PLAN

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (31)		
DRAWING NO:	RB - 31		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

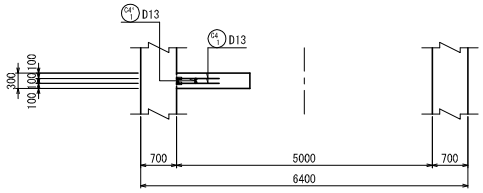
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT B (32) S=1/50

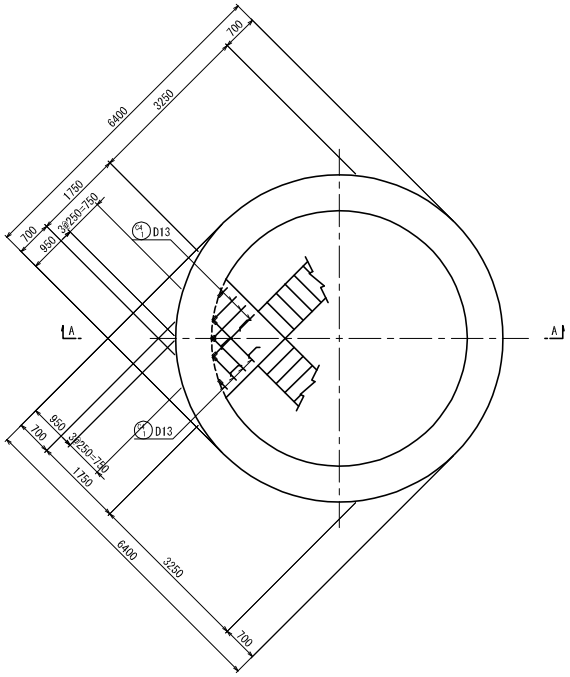
(2ND STEP)

MID SLAB-4

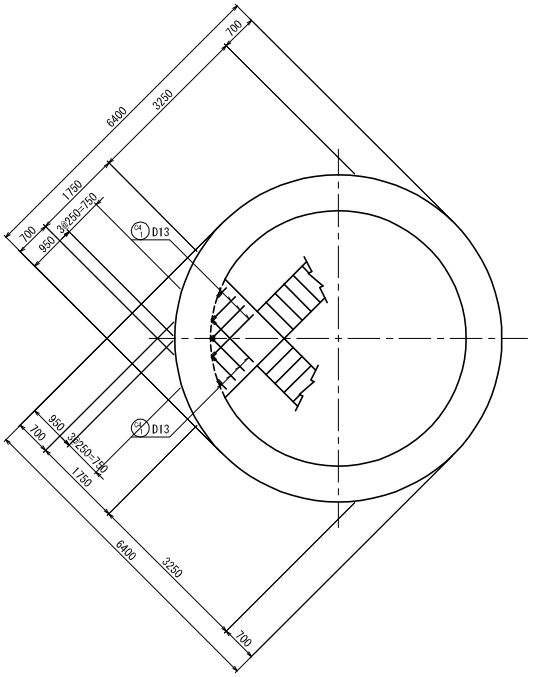
1 - 1



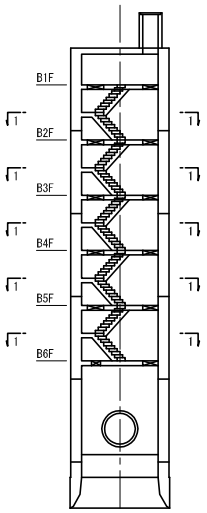
A - A



MID SLAB (UPPER)



MID SLAB (LOWER)



KEY PLAN

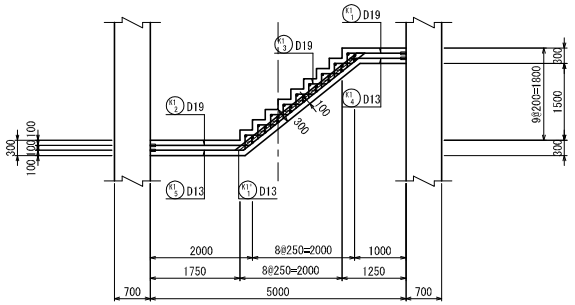
PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (32)		
DRAWING NO:	RB - 32		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

Japan International Cooperation Agency

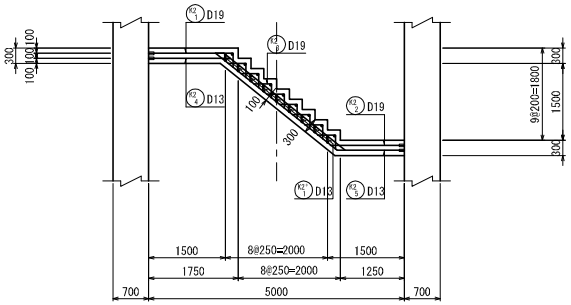
RE-BAR ARRANGEMENT OF SHAFT B (33) S=1/50

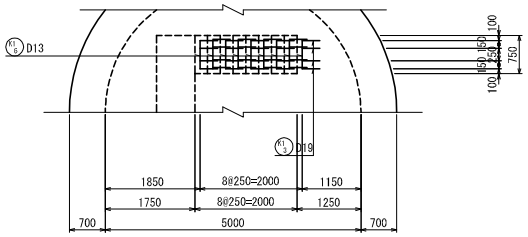
(2ND STEP)

STEP-1

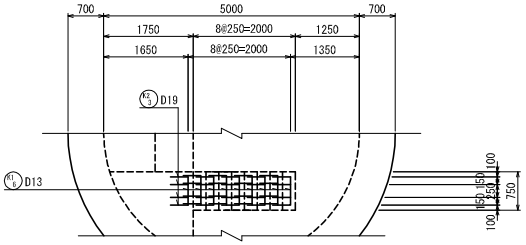


STEP-2





STEP



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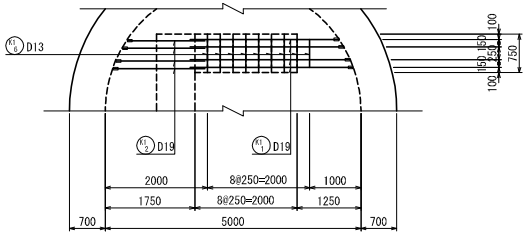
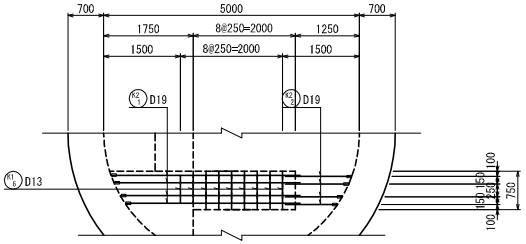
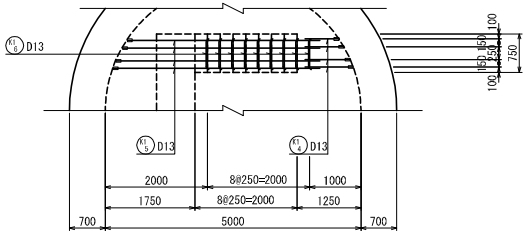


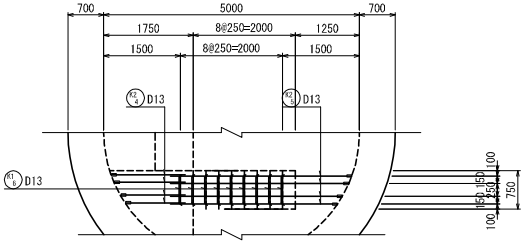
STEP SLAB (UPPER)



STEP SLAB (UPPER)



STEP SLAB (LOWER)



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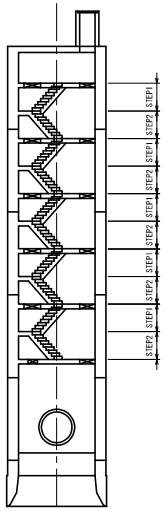
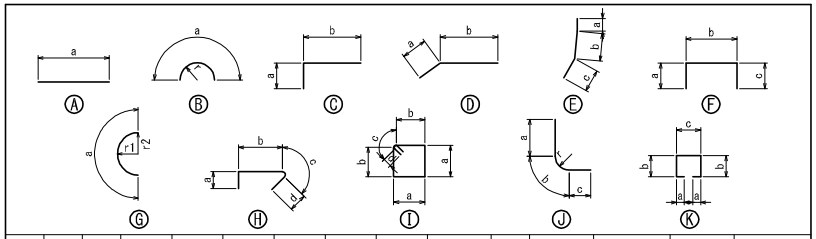


KEY PLAN

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (33)		
DRAWING NO:	RB - 33		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	
JICA	Japan International Cooperation Agency		

RE-BAR ARRANGEMENT OF SHAFT B (34)

(2ND STEP)



No.	SIZE	TIPE	a	b	c	d	r (r1)	r2	LENGTH (mm)	NUMBER	UNIT WEIGHT	WEIGHT/N	WEIGHT (kg)	REMARK
TOP SLAB														
T 1	D 22	A	2,055 ~3,350						2,710	14	3.04	8.24	115	(Av. LENGTH) (M.S.)
2	D 22	A	815 ~2,110						1,470	14	3.04	4.47	63	(Av. LENGTH) (M.S.)
3	D 22	A	3,900 ~4,118						4,010	5	3.04	12.19	61	(Av. LENGTH) (M.S.)
4	D 22	A	3,130 ~3,350						3,240	6	3.04	9.85	59	(Av. LENGTH) (M.S.)
5	D 22	A	1,890 ~2,110						2,000	6	3.04	6.08	36	(Av. LENGTH) (M.S.)
6	D 22	A	440 ~1,350						900	8	3.04	2.74	22	(Av. LENGTH) (M.S.)
7	D 22	A	3,850 ~3,900						3,880	5	3.04	11.80	59	(Av. LENGTH) (M.S.)
8	D 22	A	544 ~1,668						1,110	8	3.04	3.37	27	(Av. LENGTH) (M.S.)
9	D 19	A	1,779 ~4,370						3,080	14	2.25	6.93	97	(Av. LENGTH) (M.S.)
10	D 19	A	1,000						1,000	20	2.25	2.25	45	(M.S.)
11	D 19	A	3,900 ~4,118						4,010	5	2.25	9.02	45	(Av. LENGTH) (M.S.)
12	D 19	A	3,930 ~4,150						4,040	6	2.25	9.09	55	(Av. LENGTH) (M.S.)
13	D 19	A	440 ~1,350						900	8	2.25	2.03	16	(Av. LENGTH) (M.S.)
14	D 19	A	3,850 ~3,900						3,880	5	2.25	8.73	44	(Av. LENGTH) (M.S.)
15	D 19	A	544 ~1,668						1,110	8	2.25	2.50	20	(Av. LENGTH) (M.S.)
TH 1	D 22	A	2,680						2,680	4	3.04	8.15	33	
2	D 22	A	1,616 ~1,704						1,660	6	3.04	5.05	30	(Av. LENGTH) (M.S.)
3	D 22	A	2,580						2,580	4	3.04	7.84	31	
4	D 22	A	1,655 ~1,717						1,690	6	3.04	5.14	31	(Av. LENGTH) (M.S.)
5	D 19	A	2,500						2,500	4	2.25	5.63	23	
6	D 19	A	1,526 ~1,614						1,570	6	2.25	3.53	21	(Av. LENGTH) (M.S.)
7	D 19	A	2,400						2,400	4	2.25	5.40	22	
8	D 19	A	1,565 ~1,627						1,600	6	2.25	3.60	22	(Av. LENGTH) (M.S.)
9	D 13	A	820						820	4	0.995	0.82	3	
10	D 13	A	1,400						1,400	4	0.995	1.39	6	
11	D 13	A	767						770	4	0.995	0.77	3	(M.S.)
12	D 13	B	2,973				600		2,980	2	0.995	2.97	6	
TO 1	D 13	K	100	234	285				960	57	0.995	0.96	55	

MECHANICAL SPLICE (M.S.) NEMBER	D22 78 UNIT	D22	567 kg
	D19 78 UNIT	D19	410 kg
	D13 4 UNIT	D13	73 kg
		TOTAL	1,050 kg

VERTICAL WALL			
V 1	D 13	F	955	1,400	955				3,310	18	0.995	3.29	59	
2	D 13	C	195	2,400					2,600	15	0.995	2.59	39	
3	D 13	A	2,100						2,100	9	0.995	2.09	19	

	D13	117 kg
	TOTAL	117 kg

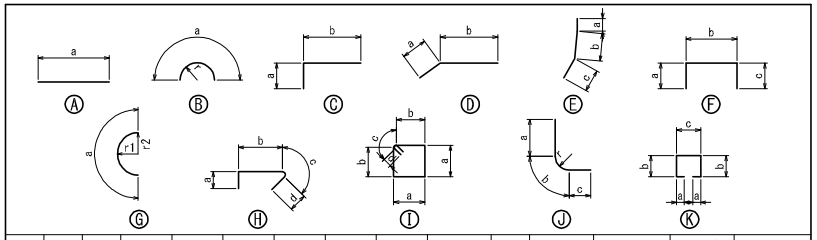
RE-BAR BENDING SCHEDULE

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (34)		
DRAWING NO:	RB - 34		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT B (35)

(2ND STEP)



No.	SIZE	TIPE	a	b	c	d	r (r1)	r2	LENGTH (mm)	NUMBER	UNIT WEIGHT	WEIGHT/N	WEIGHT (kg)	REMARK
MID SLAB-1 (B1F)														
C1 1	D 22	A	2,055 ~2,750						2,410	6	3.04	7.33	44	(Av. LENGTH) (M.S.)
2	D 22	A	815 ~1,510						1,170	6	3.04	3.56	21	(Av. LENGTH) (M.S.)
3	D 22	A	650 ~1,035						850	2	3.04	2.58	5	(Av. LENGTH) (M.S.)
4	D 22	A	400 ~900						650	19	3.04	1.98	38	(Av. LENGTH) (M.S.)
5	D 22	A	3,100 ~3,150						3,130	8	3.04	9.52	76	(Av. LENGTH) (M.S.)
6	D 22	A	3,414 ~3,452						3,440	2	3.04	10.46	21	(Av. LENGTH) (M.S.)
7	D 22	A	2,174 ~2,212						2,200	2	3.04	6.69	13	(Av. LENGTH) (M.S.)
8	D 22	A	2,895 ~3,615						3,260	3	3.04	9.91	30	(Av. LENGTH) (M.S.)
9	D 22	A	2,581 ~2,616						2,600	6	3.04	7.90	47	(Av. LENGTH) (M.S.)
10	D 22	A	2,055						2,060	2	3.04	6.26	13	(M.S.)
11	D 22	A	815						820	2	3.04	2.49	5	(M.S.)
12	D 22	A	1,900 ~2,285						2,100	4	3.04	6.38	26	(Av. LENGTH) (M.S.)
13	D 22	A	372 ~716						550	4	3.04	1.67	7	(Av. LENGTH) (M.S.)
14	D 22	A	1,380 ~1,880						1,630	3	3.04	4.96	15	(Av. LENGTH)
15	D 13	A	1,589 ~2,981						2,290	6	0.995	2.28	14	(Av. LENGTH) (M.S.)
16	D 13	A	1,000						1,000	10	0.995	1.00	10	(M.S.)
17	D 13	A	400 ~900						650	19	0.995	0.65	12	(Av. LENGTH) (M.S.)
18	D 13	A	650 ~1,035						850	2	0.995	0.85	2	(Av. LENGTH) (M.S.)
19	D 13	A	3,100 ~3,150						3,130	8	0.995	3.11	25	(Av. LENGTH) (M.S.)
20	D 13	A	4,309 ~4,385						4,350	2	0.995	4.33	9	(Av. LENGTH) (M.S.)
21	D 13	A	2,895 ~3,615						3,260	3	0.995	3.24	10	(Av. LENGTH) (M.S.)
22	D 13	A	2,581 ~2,616						2,600	6	0.995	2.59	16	(Av. LENGTH) (M.S.)
23	D 13	A	1,589						1,590	2	0.995	1.58	3	(M.S.)
24	D 13	A	372 ~716						550	4	0.995	0.55	2	(Av. LENGTH) (M.S.)
25	D 13	A	1,900 ~2,285						2,100	4	0.995	2.09	8	(Av. LENGTH) (M.S.)
26	D 13	A	1,380 ~1,880						1,630	3	0.995	1.62	5	(Av. LENGTH)
CH1 1	D 29	A	2,851 ~2,877						2,870	8	5.04	14.46	116	(Av. LENGTH) (M.S.)
2	D 16	A	2,441 ~2,467						2,460	8	1.56	3.84	31	(Av. LENGTH) (M.S.)
3	D 13	A	3,681						3,690	2	0.995	3.67	7	
4	D 13	A	2,410						2,410	2	0.995	2.40	5	
5	D 13	A	1,770						1,770	2	0.995	1.76	4	
6	D 13	A	2,431						2,440	2	0.995	2.43	5	
7	D 13	A	1,160						1,160	2	0.995	1.15	2	
8	D 13	A	2,120						2,120	2	0.995	2.11	4	
9	D 13	A	1,424						1,430	4	0.995	1.42	6	(M.S.)
10	D 13	A	820						820	4	0.995	0.82	3	
C1' 1	D 13	K	100	131	285				750	46	0.995	0.75	35	

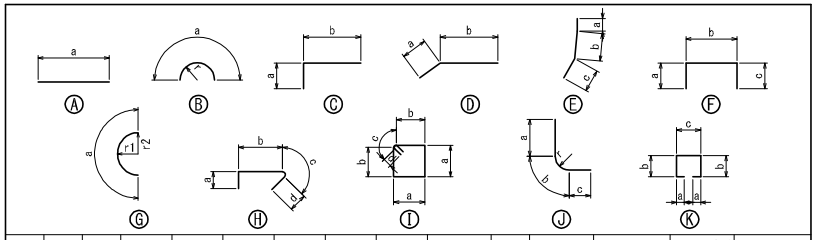
MECHANICAL SPLICE (M.S.) NEMBER	D29	8 UNIT	D29 116 kg
	D22	66 UNIT	D22 361 kg
	D16	8 UNIT	D16 31 kg
	D13	70 UNIT	D13 187 kg
			TOTAL 695 kg

RE-BAR BENDING SCHEDULE

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (35)		
DRAWING NO:	RB - 35		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	
Japan International Cooperation Agency			

RE-BAR ARRANGEMENT OF SHAFT B (36)

(2ND STEP)



No.	SIZE	TIPE	a	b	c	d	r(r1)	r2	LENGTH(mm)	NUMBER	UNIT WEIGHT	WEIGHT/N	WEIGHT(kg)	REMARK
MID SLAB-2:PER ONEUNIT (B2F～B5F)														
C2 1	D 22	A	2,055 ～2,750						2,410	6	3.04	7.33	44	(Av.LENGTH) (M.S.)
2	D 22	A	815 ～1,510						1,170	6	3.04	3.56	21	(Av.LENGTH) (M.S.)
3	D 22	A	650 ～1,035						850	4	3.04	2.58	10	(Av.LENGTH) (M.S.)
4	D 22	A	400 ～900						650	24	3.04	1.98	48	(Av.LENGTH) (M.S.)
5	D 22	A	3,100 ～3,150						3,130	10	3.04	9.52	95	(Av.LENGTH) (M.S.)
6	D 22	A	1,380 ～1,880						1,630	6	3.04	4.96	30	(Av.LENGTH)
7	D 22	A	372 ～716						550	4	3.04	1.67	7	(Av.LENGTH) (M.S.)
8	D 22	A	2,581 ～2,616						2,600	6	3.04	7.90	47	(Av.LENGTH) (M.S.)
9	D 22	A	2,055						2,060	2	3.04	6.26	13	(M.S.)
10	D 22	A	815						820	2	3.04	2.49	5	(M.S.)
11	D 13	A	1,589 ～2,981						2,290	6	0.995	2.28	14	(Av.LENGTH) (M.S.)
12	D 13	A	1,000						1,000	8	0.995	1.00	8	(M.S.)
13	D 13	A	650 ～1,035						850	4	0.995	0.85	3	(Av.LENGTH) (M.S.)
14	D 13	A	400 ～900						650	24	0.995	0.65	16	(Av.LENGTH) (M.S.)
15	D 13	A	3,100 ～3,150						3,130	10	0.995	3.11	31	(Av.LENGTH) (M.S.)
16	D 13	A	1,380 ～1,880						1,630	6	0.995	1.62	10	(Av.LENGTH)
17	D 13	A	372 ～716						550	4	0.995	0.55	2	(Av.LENGTH) (M.S.)
18	D 13	A	2,581 ～2,616						2,600	6	0.995	2.59	16	(Av.LENGTH) (M.S.)
19	D 13	A	1,589						1,590	2	0.995	1.58	3	(M.S.)
CH2 1	D 29	A	2,851 ～2,877						2,870	8	5.04	14.46	116	(Av.LENGTH) (M.S.)
2	D 16	A	2,441 ～2,467						2,460	8	1.56	3.84	31	(Av.LENGTH) (M.S.)
3	D 13	A	3,681						3,690	4	0.995	3.67	15	
4	D 13	A	2,410						2,410	4	0.995	2.40	10	
5	D 13	A	1,770						1,770	2	0.995	1.76	4	
6	D 13	A	2,120						2,120	2	0.995	2.11	4	
7	D 13	A	1,424						1,430	4	0.995	1.42	6	(M.S.)
8	D 13	A	820						820	4	0.995	0.82	3	
C2' 1	D 13	K	100	131	285				750	41	0.995	0.75	31	

MECHANICAL SPLICE(M.S.) NEMBER	D29	8 UNIT	D29	116 kg
	D22	64 UNIT	D22	320 kg
	D16	8 UNIT	D16	31 kg
	D13	68 UNIT	D13	176 kg
			TOTAL	643 kg

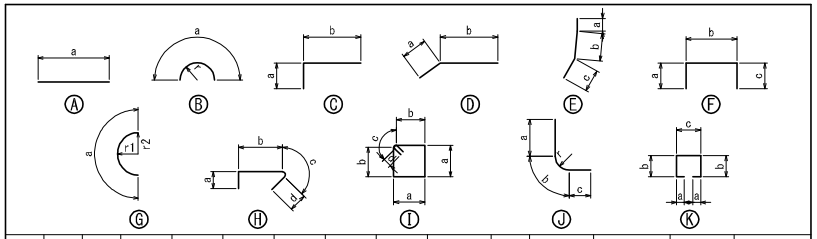
RE-BAR BENDING SCHEDULE

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (36)
DRAWING NO:	RB - 36
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY
DESIGNED BY: SHIMAO HIDAKA	DATE:
CHECKED BY: HARUTOSHI UCHIDA	DATE:

Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT B (37)

(2ND STEP)



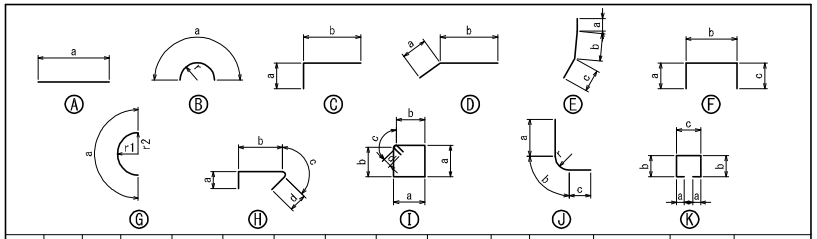
No.	SIZE	TIPE	a	b	c	d	r (r1)	r2	LENGTH (mm)	NUMBER	UNIT WEIGHT	WEIGHT/N	WEIGHT (kg)	REMARK
MID SLAB-3 (B6F)														
C3 1	D 19	A	693 ~1,154						930	4	2.25	2.09	8	(Av. LENGTH) (M.S.)
2	D 19	A	2,623 ~3,337						2,980	10	2.25	6.71	67	(Av. LENGTH) (M.S.)
3	D 19	A	1,546 ~2,263						1,910	10	2.25	4.30	43	(Av. LENGTH) (M.S.)
4	D 19	A	2,895 ~3,615						3,260	6	2.25	7.34	44	(Av. LENGTH) (M.S.)
5	D 19	A	2,581 ~2,616						2,600	6	2.25	5.85	35	(Av. LENGTH) (M.S.)
6	D 19	A	1,927						1,930	2	2.25	4.34	9	(M.S.)
7	D 19	A	852						860	2	2.25	1.94	4	(M.S.)
8	D 19	A	372 ~716						550	4	2.25	1.24	5	(Av. LENGTH) (M.S.)
9	D 19	A	1,927 ~3,287						2,610	9	2.25	5.87	53	(Av. LENGTH) (M.S.)
10	D 19	A	852 ~2,212						1,540	9	2.25	3.47	31	(Av. LENGTH) (M.S.)
11	D 19	A	4,300 ~4,375						4,340	3	2.25	9.77	29	(Av. LENGTH) (M.S.)
12	D 13	A	693 ~1,154						930	4	0.995	0.93	4	(Av. LENGTH) (M.S.)
13	D 13	A	2,981 ~4,410						3,700	10	0.995	3.68	37	(Av. LENGTH) (M.S.)
14	D 13	A	1,000						1,000	21	0.995	1.00	21	(M.S.)
15	D 13	A	2,895 ~3,615						3,260	6	0.995	3.24	19	(Av. LENGTH) (M.S.)
16	D 13	A	2,581 ~2,616						2,600	6	0.995	2.59	16	(Av. LENGTH) (M.S.)
17	D 13	A	1,589						1,590	2	0.995	1.58	3	(M.S.)
18	D 13	A	372 ~716						550	4	0.995	0.55	2	(Av. LENGTH) (M.S.)
19	D 13	A	1,589 ~4,309						2,950	9	0.995	2.94	26	(Av. LENGTH) (M.S.)
20	D 13	A	4,300 ~4,375						4,340	3	0.995	4.32	13	(Av. LENGTH) (M.S.)
CH3 1	D 19	A	2,000						2,000	2	2.25	4.50	9	
2	D 19	A	1,237 ~1,268						1,260	4	2.25	2.84	11	(Av. LENGTH) (M.S.)
3	D 13	A	1,620						1,620	2	0.995	1.61	3	
4	D 13	A	1,047 ~1,078						1,070	4	0.995	1.06	4	(Av. LENGTH) (M.S.)
5	D 13	A	1,000						1,000	4	0.995	1.00	4	
6	D 13	A	502						510	4	0.995	0.51	2	(M.S.)
7	D 13	B	1,889				400		1,890	2	0.995	1.88	4	
8	D 13	A	2,120						2,120	2	0.995	2.11	4	
9	D 13	A	1,424						1,430	4	0.995	1.42	6	(M.S.)
10	D 13	A	820						820	4	0.995	0.82	3	
C3' 1	D 13	K	100	131	285				750	62	0.995	0.75	47	
MECHANICAL SPLICE (M.S.) NEMBER									D19 69 UNIT		D19	348 kg		
									D13 77 UNIT		D13	218 kg		
											TOTAL	566 kg		

RE-BAR BENDING SCHEDULE

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (37)		
DRAWING NO:	RB - 37		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	
JICA	Japan International Cooperation Agency		

RE-BAR ARRANGEMENT OF SHAFT B (38)

(2ND STEP)



No.	SIZE	TIPE	a	b	c	d	r(r1)	r2	LENGTH(mm)	NUMBER	UNIT WEIGHT	WEIGHT/N	WEIGHT(kg)	REMARK
MID SLAB-4:PER ONEUNIT (5UNIT)														
C4 1	D 13	A	240 ~1,150						700	16	0.995	0.70	11	(Av.LENGTH) (M.S.)
C4' 1	D 13	K	100	129	282				740	4	0.995	0.74	3	
MECHANICAL SPLICE(M.S.) NEMBER D13 16 UNIT											D13	14 kg		
											TOTAL	14 kg		
STEP-1:PER ONEUNIT (5UNIT)														
K1 1	D 19	D	3,042	536 ~816					3,720	4	2.25	8.37	33	(Av.LENGTH) (M.S.)
2	D 19	A	1,516 ~1,796						1,660	4	2.25	3.74	15	(Av.LENGTH) (M.S.)
3	D 19	C	276	345					630	36	2.25	1.42	51	
4	D 13	A	661 ~941						810	4	0.995	0.81	3	(Av.LENGTH) (M.S.)
5	D 13	D	3,042	1,391 ~1,671					4,580	4	0.995	4.56	18	(Av.LENGTH) (M.S.)
6	D 13	A	550						550	27	0.995	0.55	15	
K1' 1	D 13	K	100	157	582				1,100	9	0.995	1.09	10	
MECHANICAL SPLICE(M.S.) NEMBER D19 8 UNIT											D19	99 kg		
											D13 8 UNIT	D13	46 kg	
											TOTAL	145 kg		
STEP-2:PER ONEUNIT (5UNIT)														
K2 1	D 19	D	3,042	1,036 ~1,316					4,220	4	2.25	9.50	38	(Av.LENGTH) (M.S.)
2	D 19	A	1,016 ~1,296						1,160	4	2.25	2.61	10	(Av.LENGTH) (M.S.)
3	D 19	C	276	345					630	36	2.25	1.42	51	
4	D 13	A	1,161 ~1,441						1,310	4	0.995	1.30	5	(Av.LENGTH) (M.S.)
5	D 13	D	3,042	891 ~1,171					4,080	4	0.995	4.06	16	(Av.LENGTH) (M.S.)
6	D 13	A	550						550	27	0.995	0.55	15	
K2' 1	D 13	K	100	157	582				1,100	9	0.995	1.09	10	
MECHANICAL SPLICE(M.S.) NEMBER D19 8 UNIT											D19	99 kg		
											D13 8 UNIT	D13	46 kg	
											TOTAL	145 kg		
TOTAL NUMBER OF MECHANICAL SPLICE											TOTAL WEIGHT OF RE-BAR			
D29 40 UNIT											D29	580 kg		
D25 0 UNIT											D25	0 kg		
D22 400 UNIT											D22	2,208 kg		
D19 227 UNIT											D19	1,748 kg		
D16 40 UNIT											D16	155 kg		
D13 583 UNIT											D13	1,829 kg		
TOTAL 1,290 UNIT											TOTAL	6,520 kg		

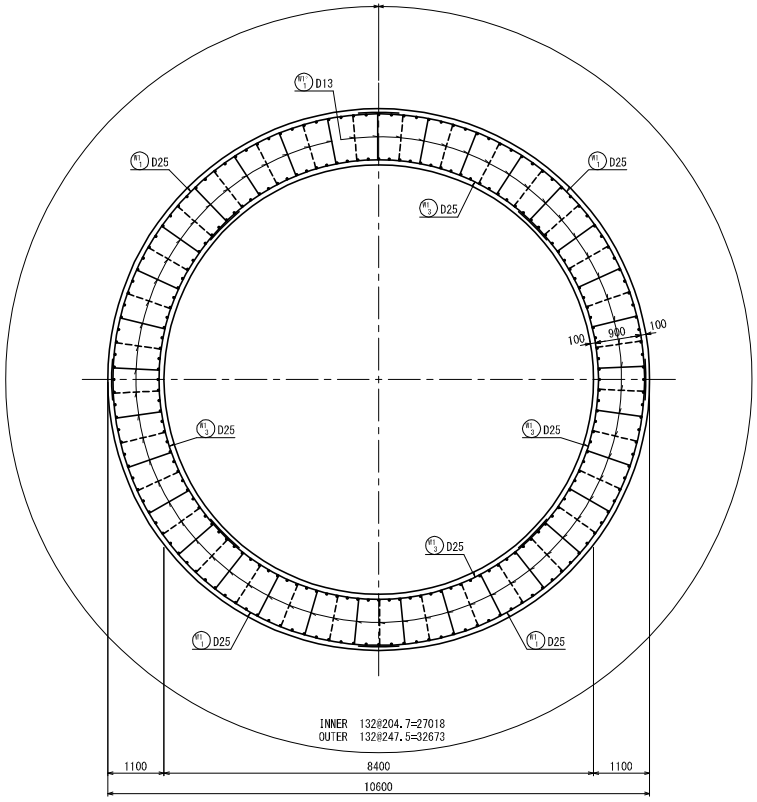
RE-BAR BENDING SCHEDULE

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT B (38)
DRAWING NO:	RB - 38
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY
DESIGNED BY:	SHIMAO HIDAKA — DATE:
CHECKED BY:	HARUTOSHI UCHIDA — DATE:

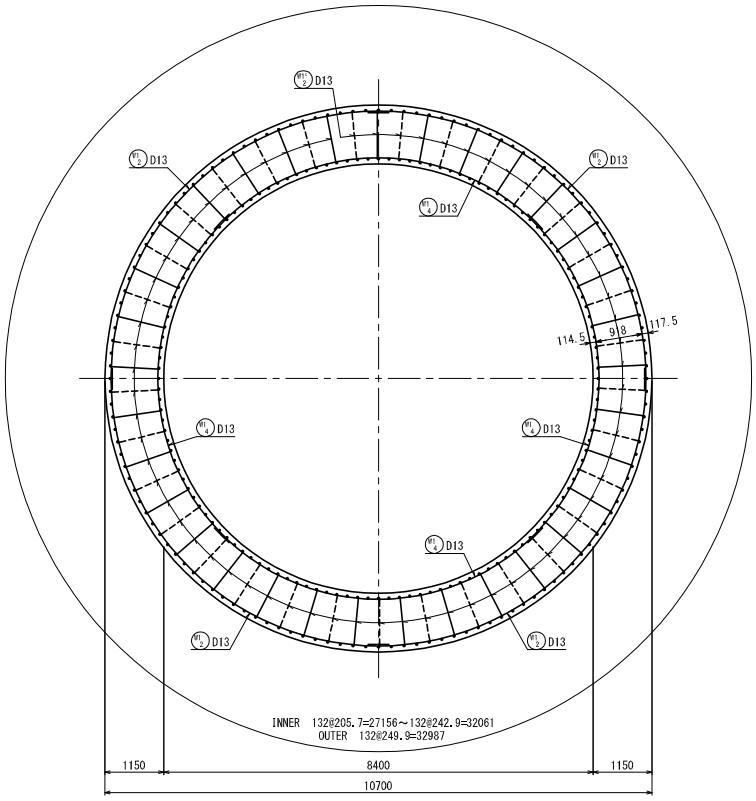
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT C （1） S=1/50

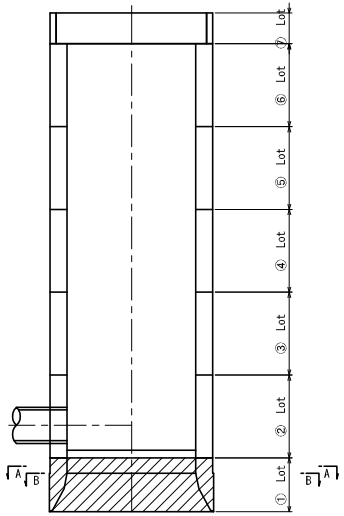
(1ST STEP)



A - A



B - B

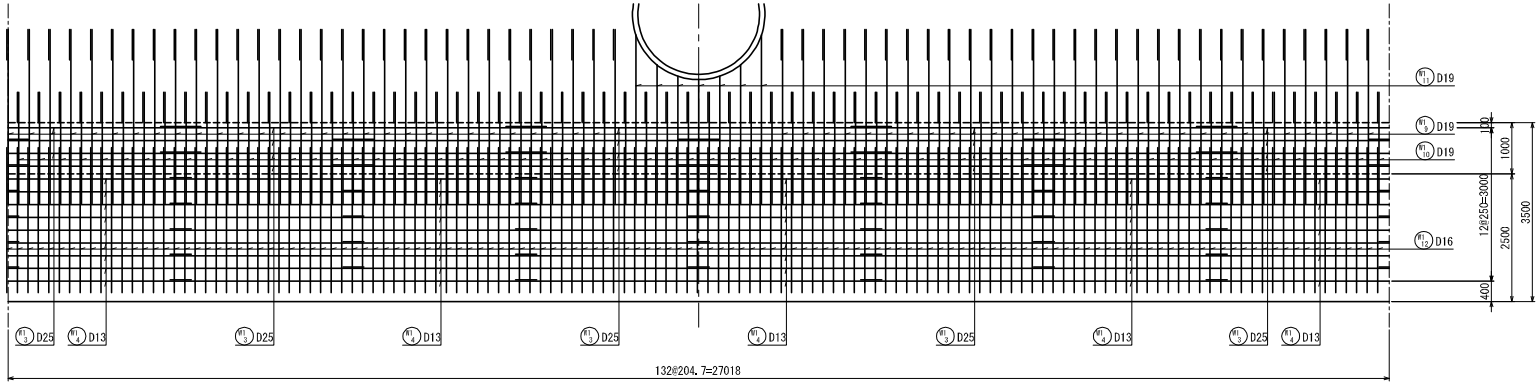


KEY PLAN

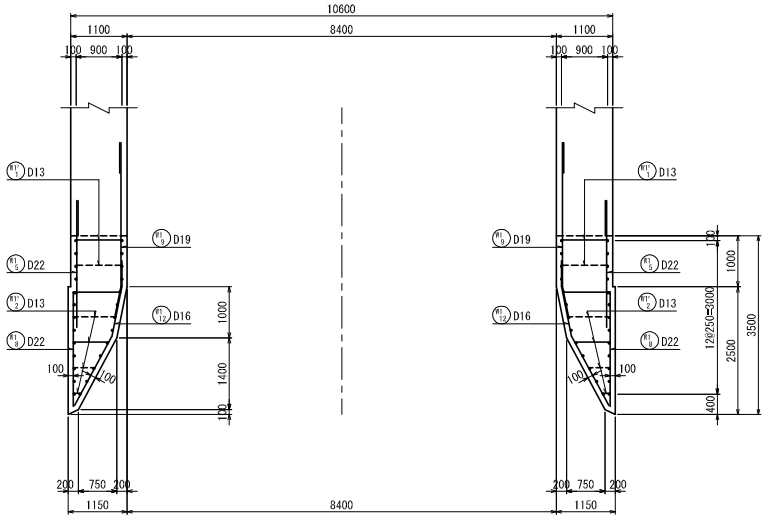
PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT C (1)		
DRAWING NO:	RC - 01		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	
JICA	Japan International Cooperation Agency		

RE-BAR ARRANGEMENT OF SHAFT C (2) S=1/50

(1ST STEP)



SIDEWALL(INNER)

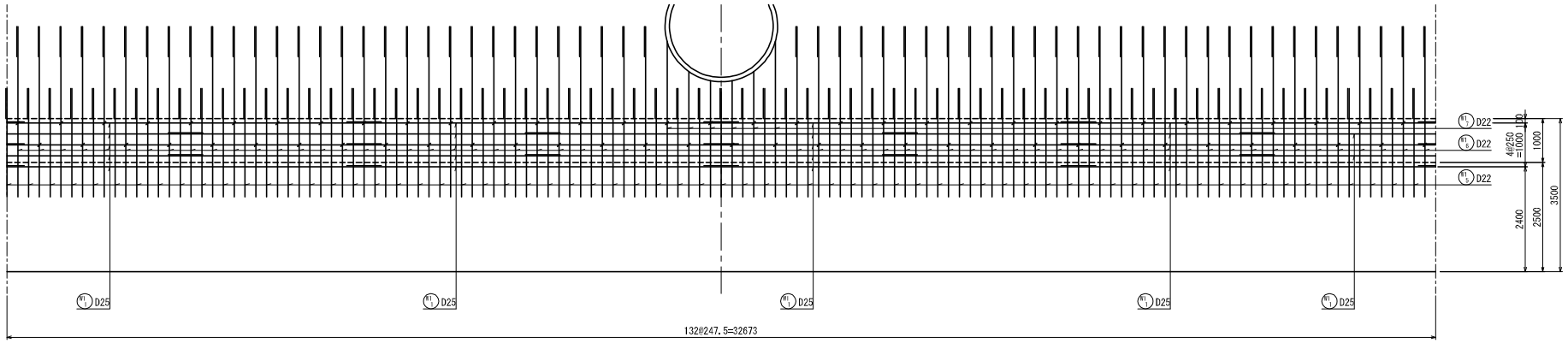


C - C

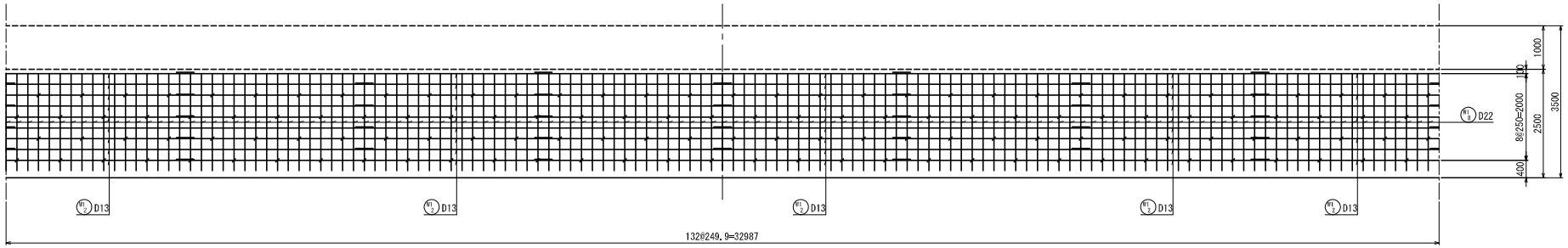
PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT C (2)		
DRAWING NO:	RC - 02		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	
Japan International Cooperation Agency			

RE-BAR ARRANGEMENT OF SHAFT C (3) S=1/50

(1ST STEP)



SIDEWALL (OUTER)



TOE OF SHAFT

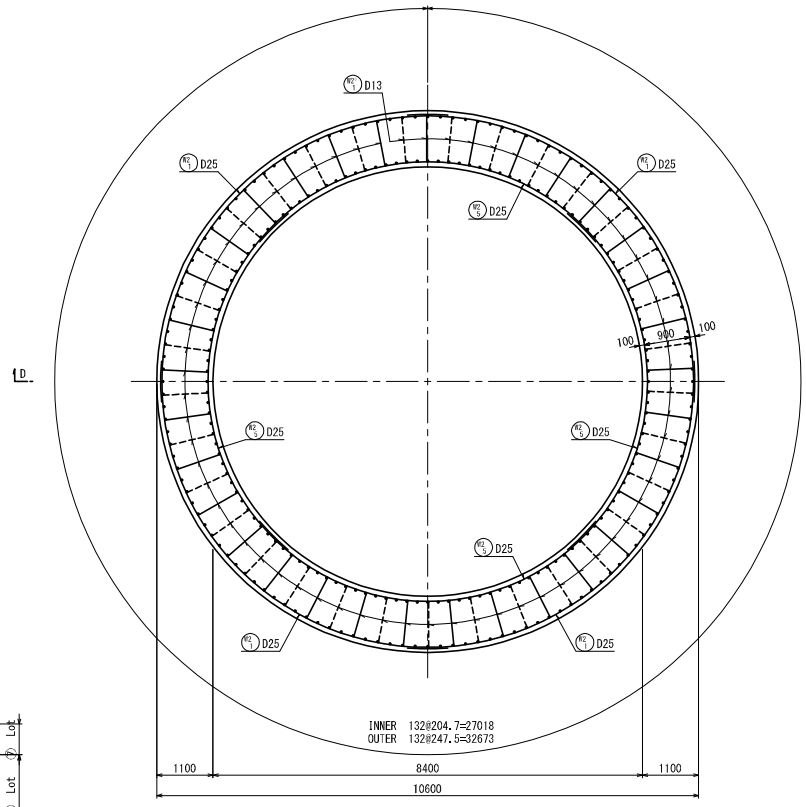
PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT C (3)
DRAWING NO:	RC - 03
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY

DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

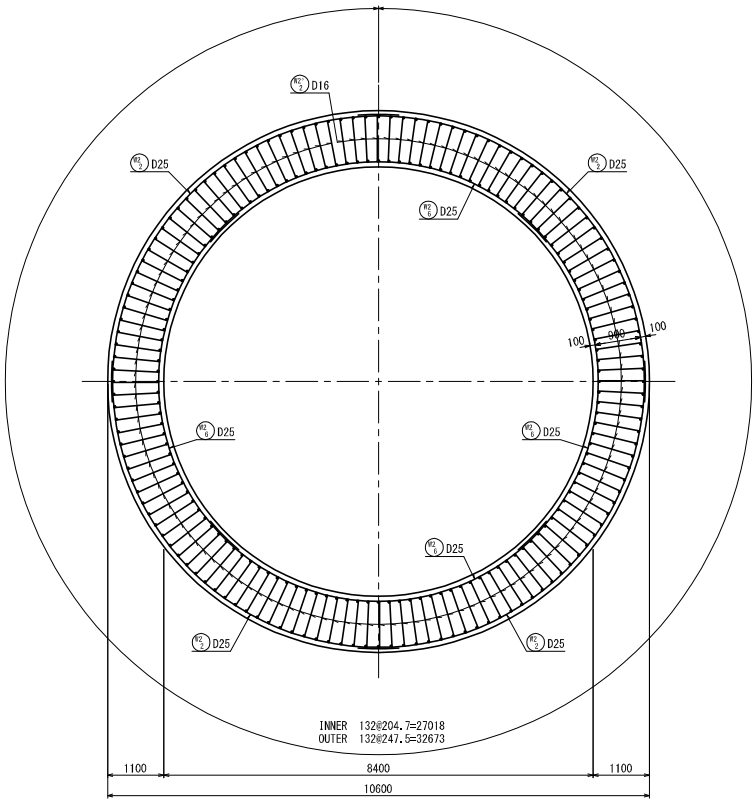
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT C (4) S=1/50

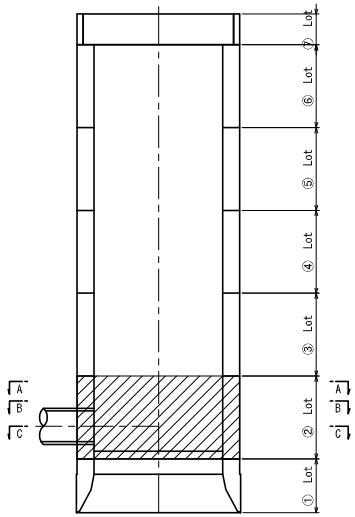
(1ST STEP)



A - A



B - B



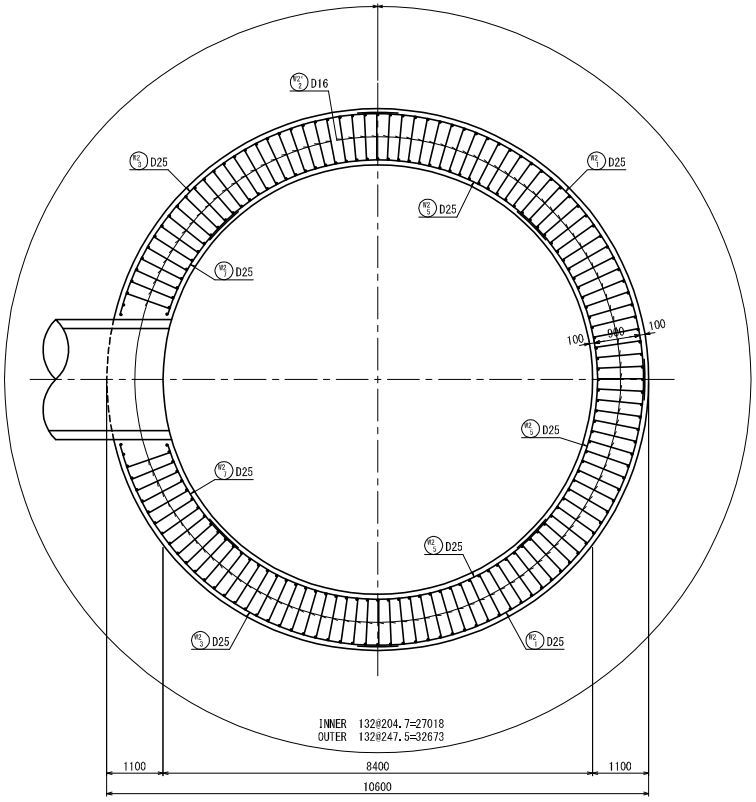
KEY PLAN

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT C (4)		
DRAWING NO:	RC - 04		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

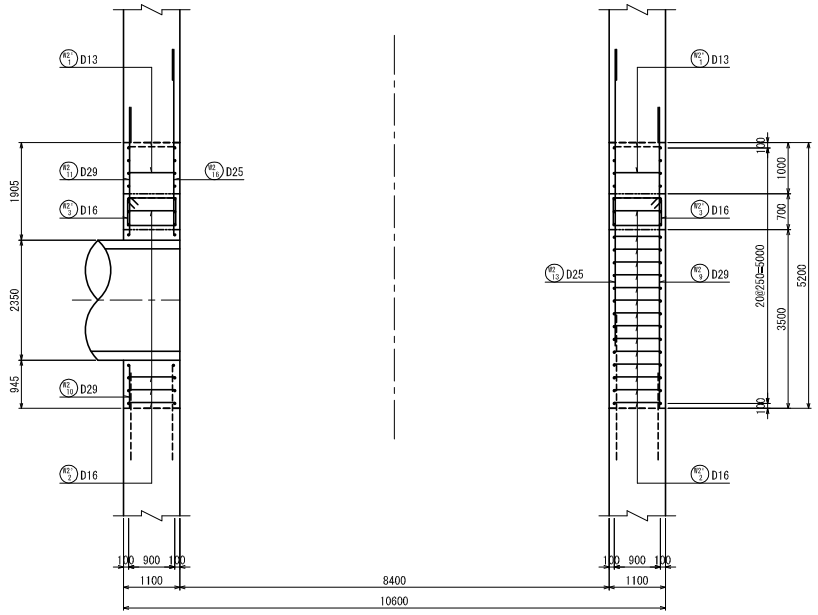
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT C (5) S=1/50

(1ST STEP)



C - C



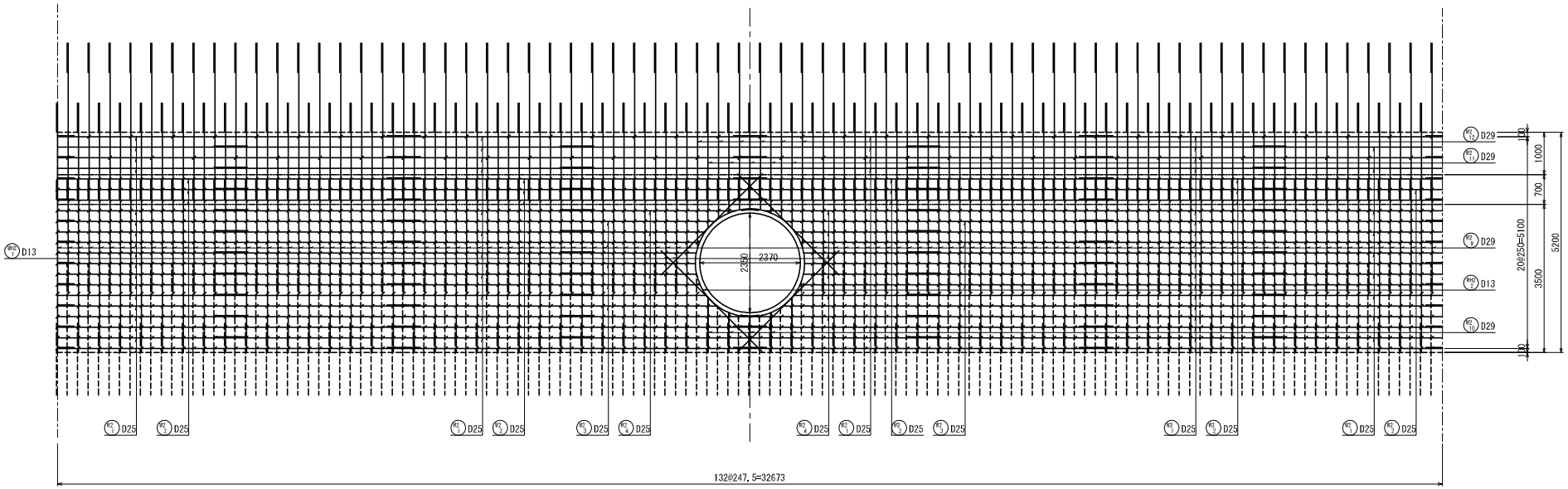
D - D

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT C (5)
DRAWING NO:	RC - 05
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY
DESIGNED BY:	SHIMAO HIDAKA — DATE:
CHECKED BY:	HARUTOSHI UCHIDA — DATE:

Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT C (6) S=1/50

(1ST STEP)



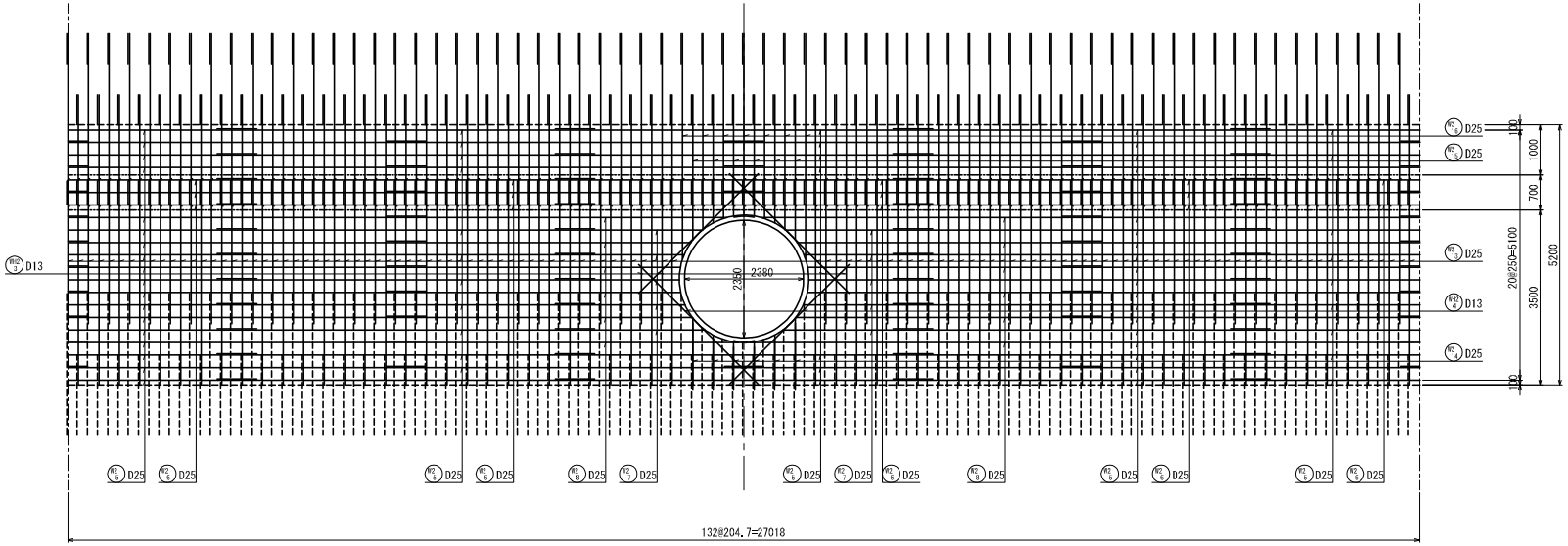
SIDEWALL(OUTER)

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT C (6)		
DRAWING NO:	RC - 06		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT C (7) S=1/50

(1ST STEP)



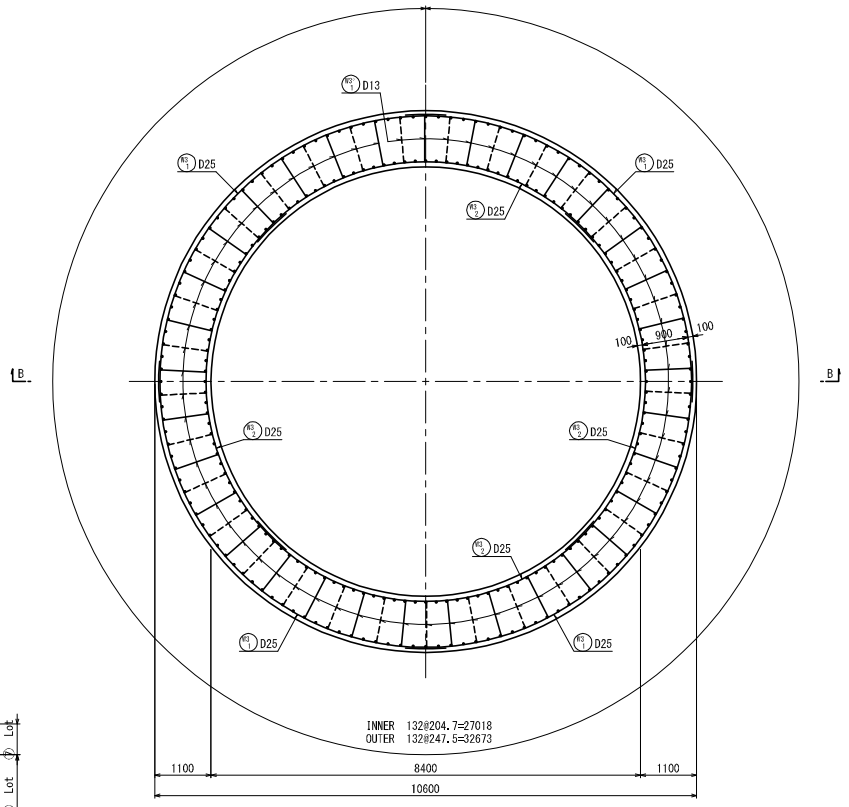
SIDEWALL(INNER)

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT C (7)		
DRAWING NO:	RC - 07		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

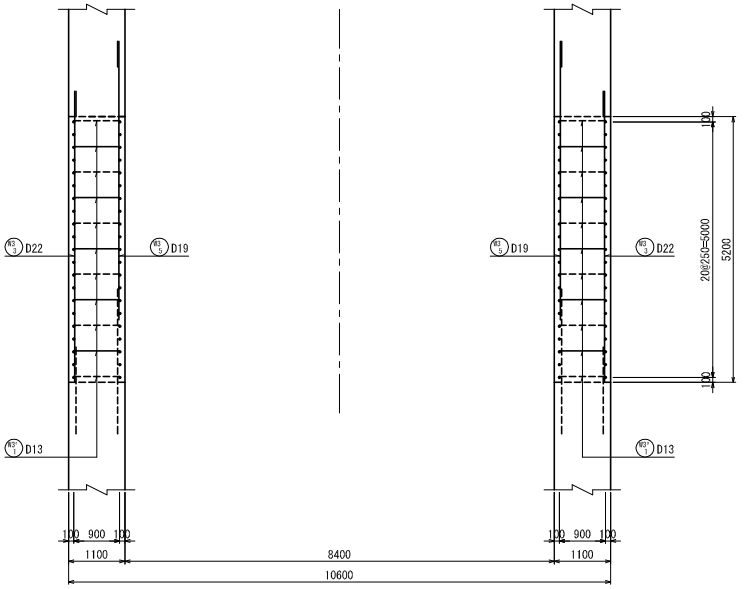
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT C (8) S=1/50

(1ST STEP)



A - A



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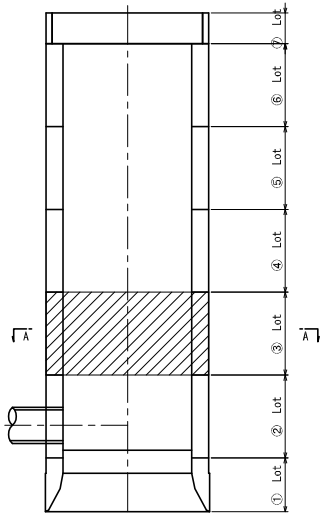


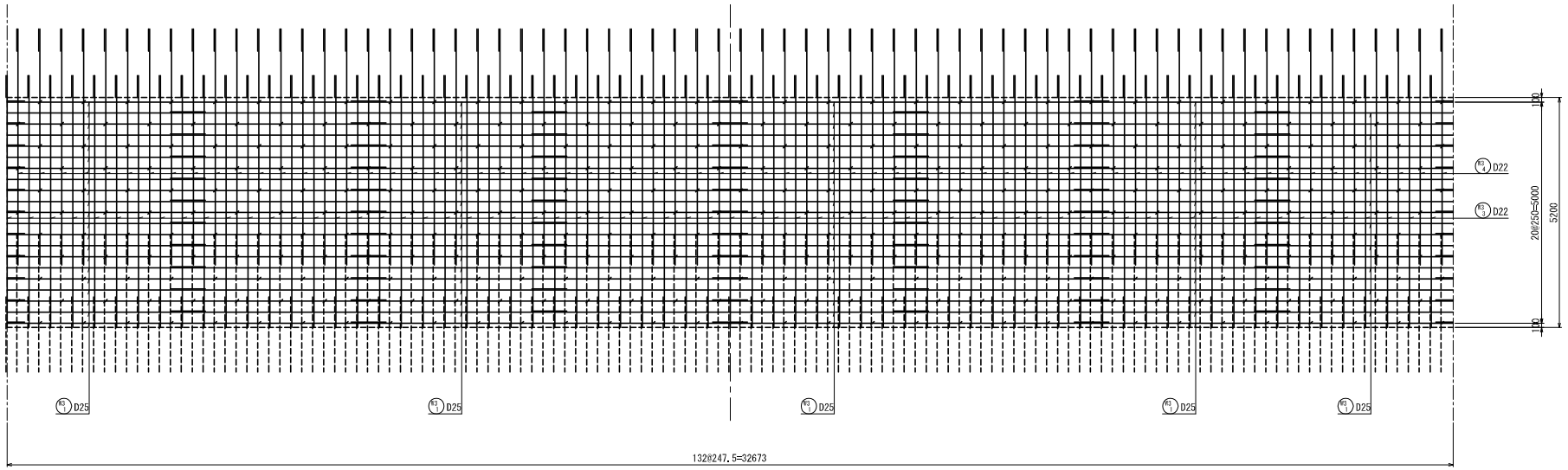
KEY PLAN

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT C (8)		
DRAWING NO:	RC - 08		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT C (9) S=1/50

(1ST STEP)



SIDEWALL (OUTER)

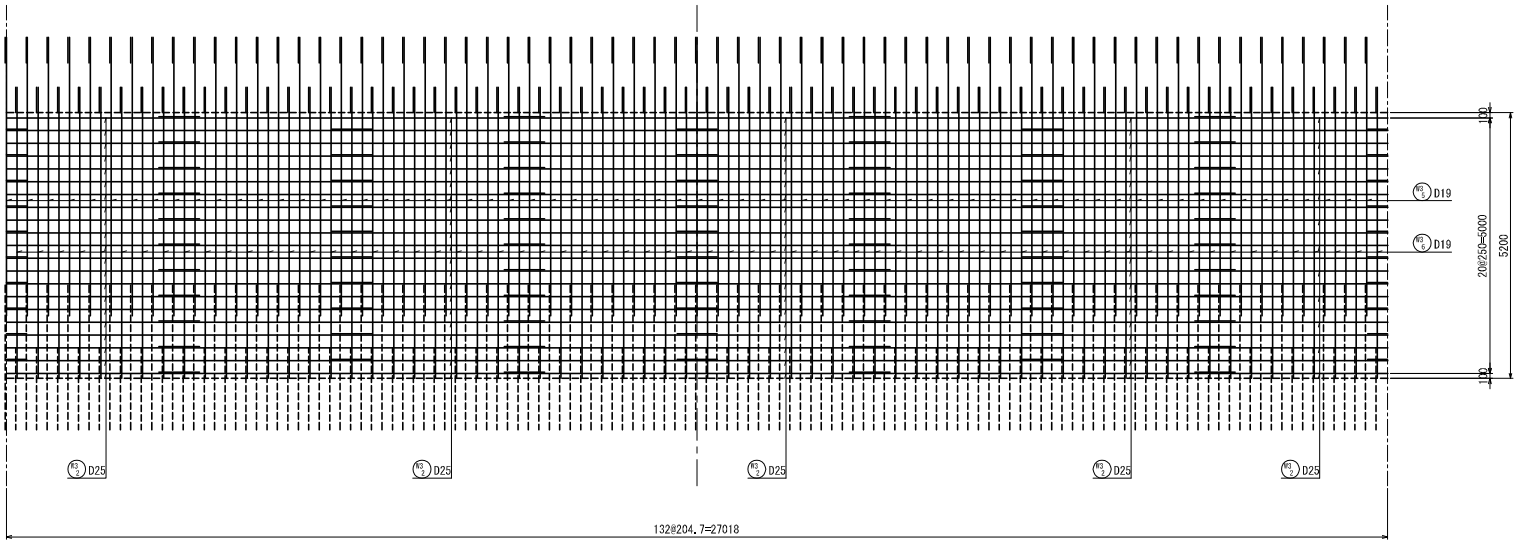
PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT C (9)
DRAWING NO:	RC - 09
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY

DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT C (10) S=1/50

(1ST STEP)



SIDEWALL(INNER)

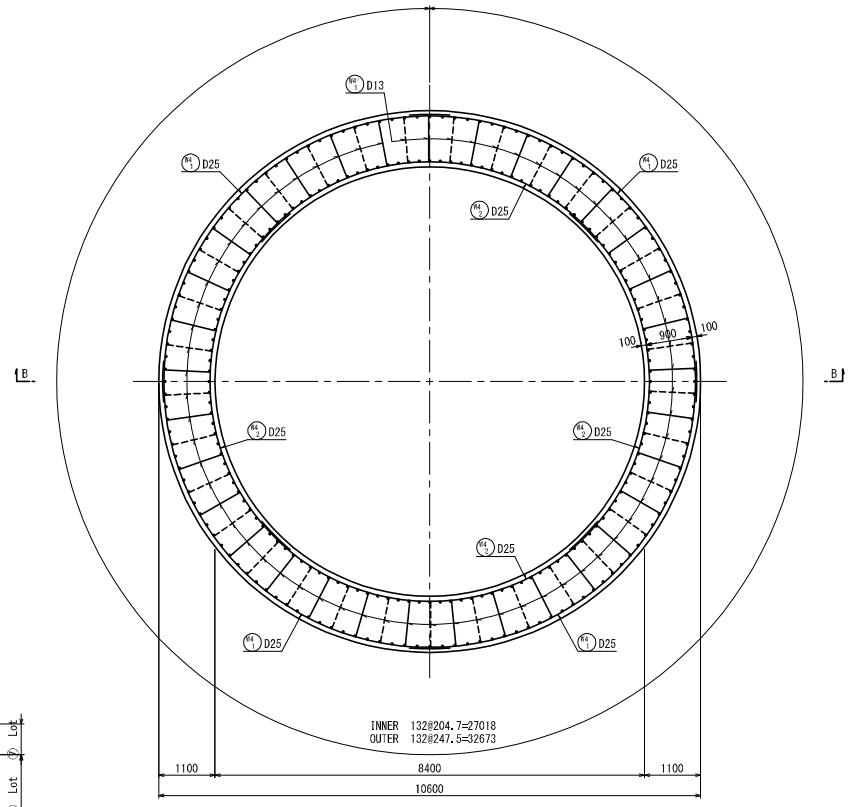
PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT C (10)
DRAWING NO:	RC - 10
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY

DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

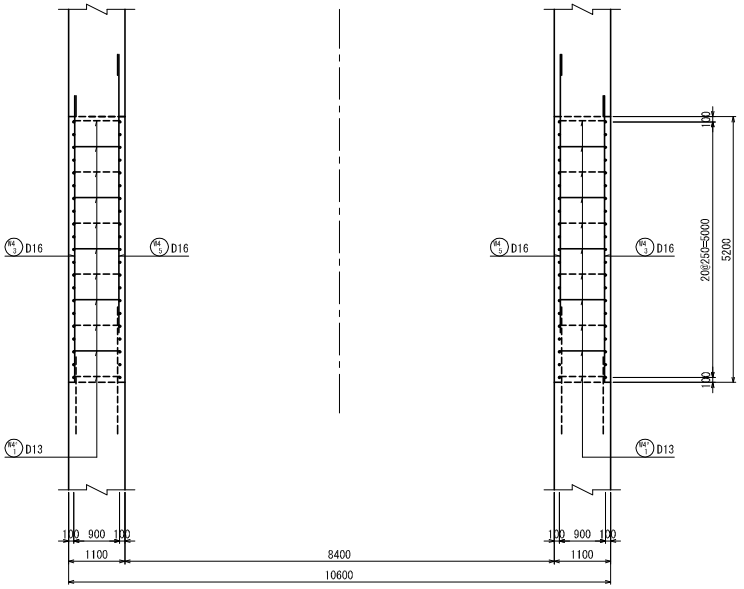
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT C (11) S=1/50

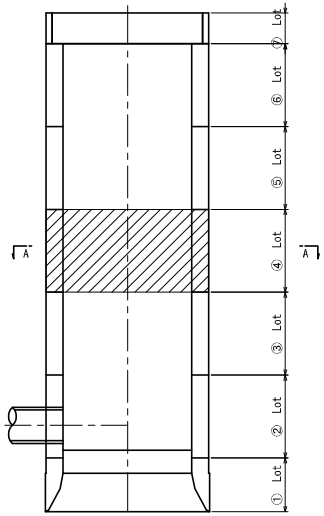
(1ST STEP)



A - A



B - B



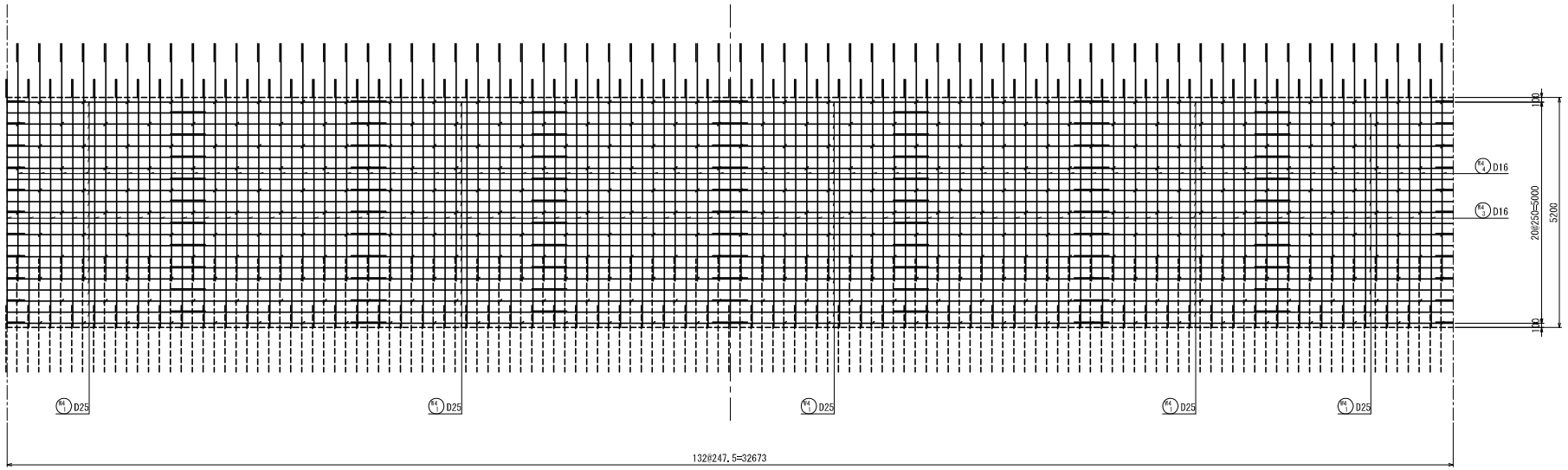
KEY PLAN

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT C (11)		
DRAWING NO:	RC - 11		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT C (12) S=1/50

(1ST STEP)



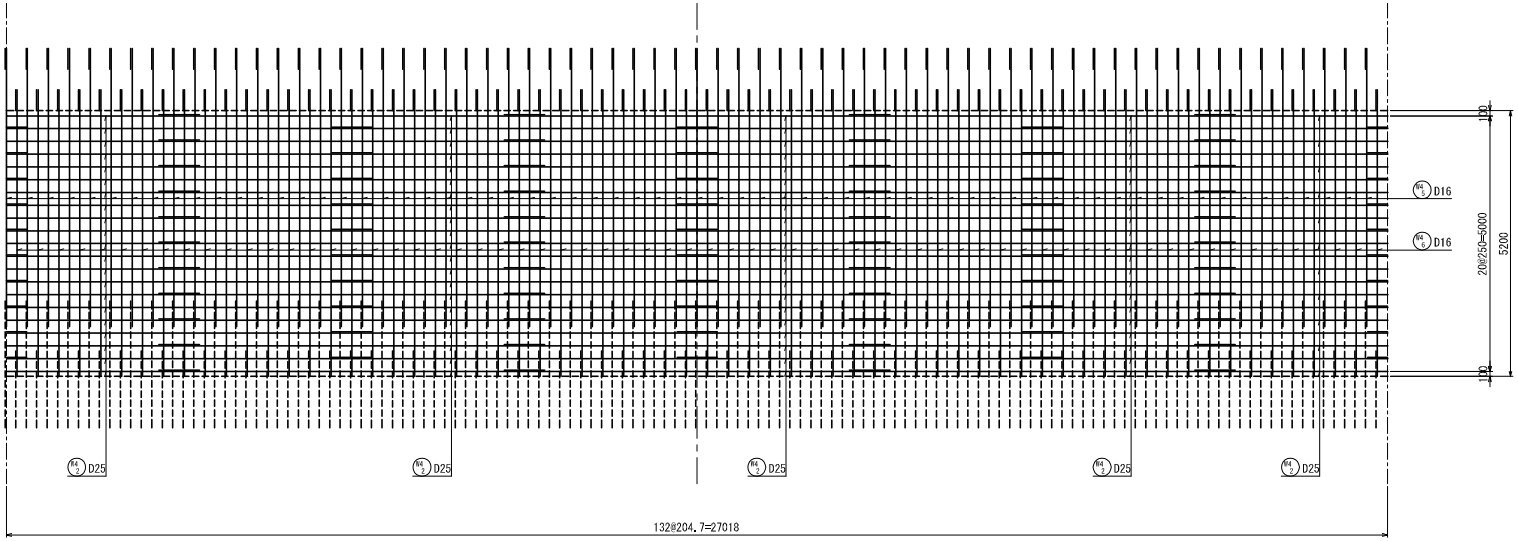
SIDEWALL(OUTER)

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT C (12)		
DRAWING NO:	RC - 12		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT C (13) S=1/50

(1ST STEP)



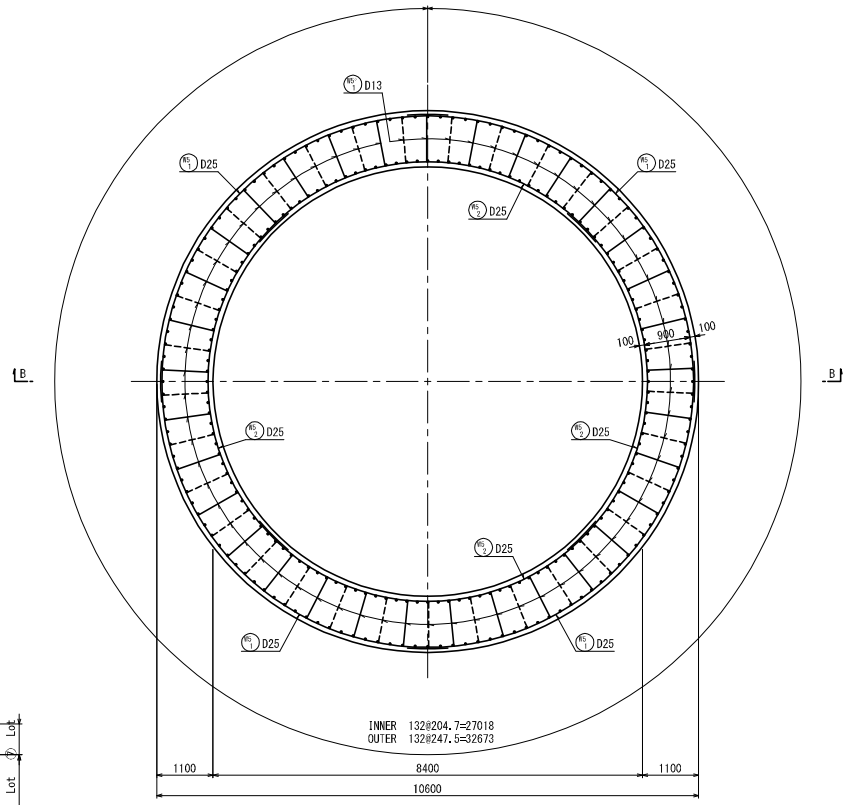
SIDEWALL(INNER)

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT C (13)		
DRAWING NO:	RC - 13		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

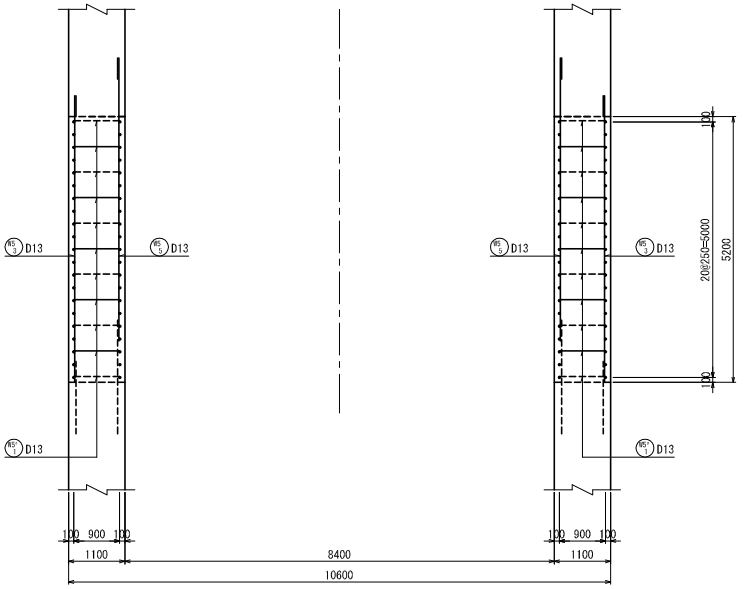
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT C (14) S=1/50

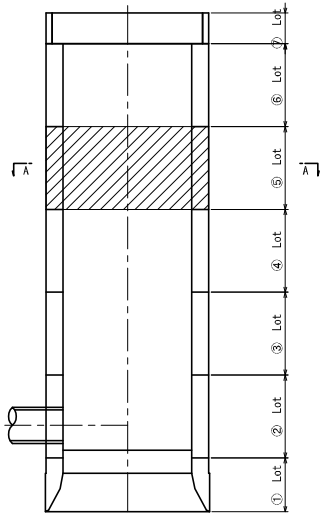
(1ST STEP)



A - A



B - B



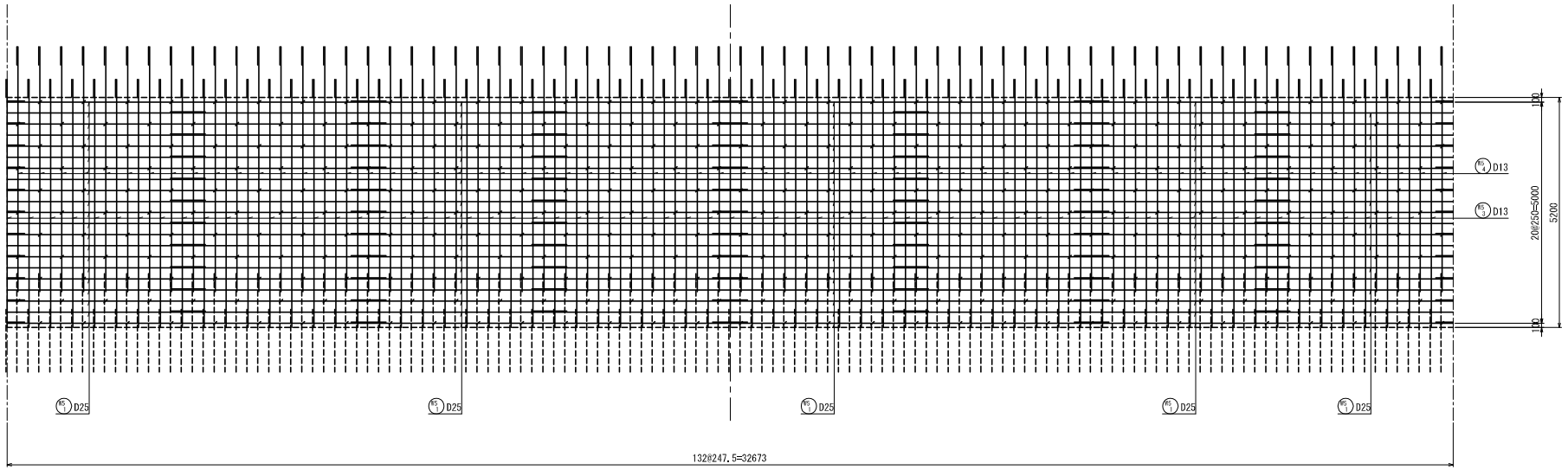
KEY PLAN

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT C (14)		
DRAWING NO:	RC - 14		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT C (15) S=1/50

(1ST STEP)



SIDEWALL (OUTER)

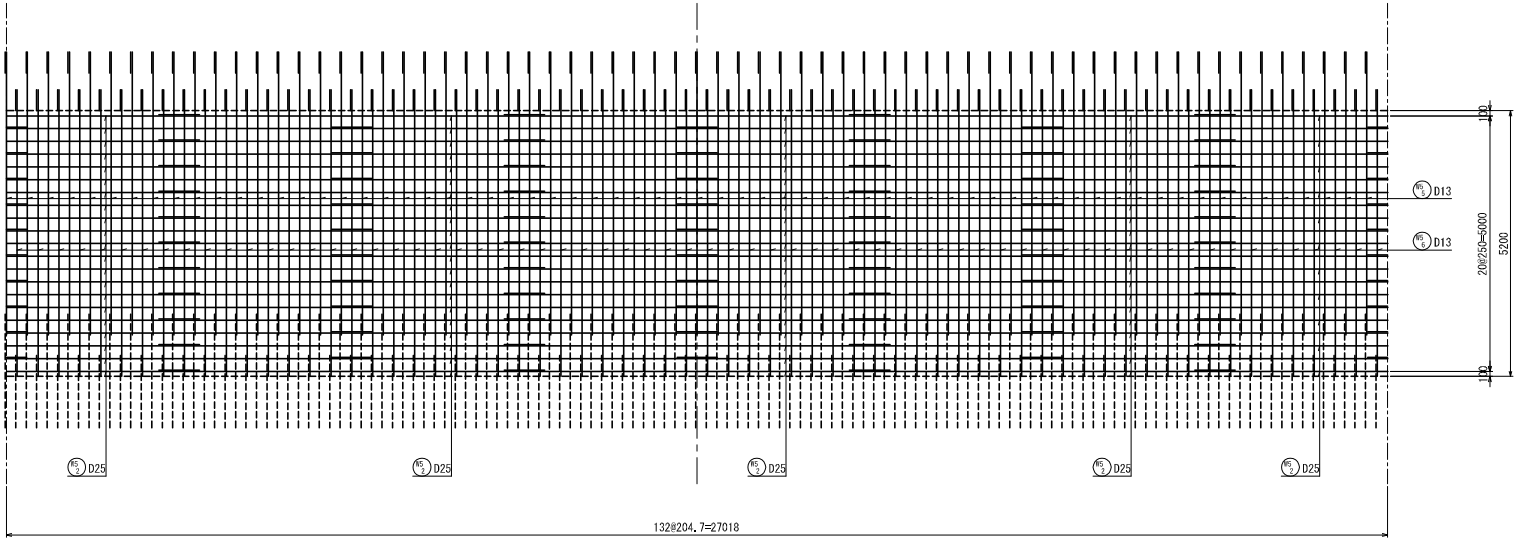
PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT C (15)
DRAWING NO:	RC - 15
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY

DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT C (16) S=1/50

(1ST STEP)



SIDEWALL(INNER)

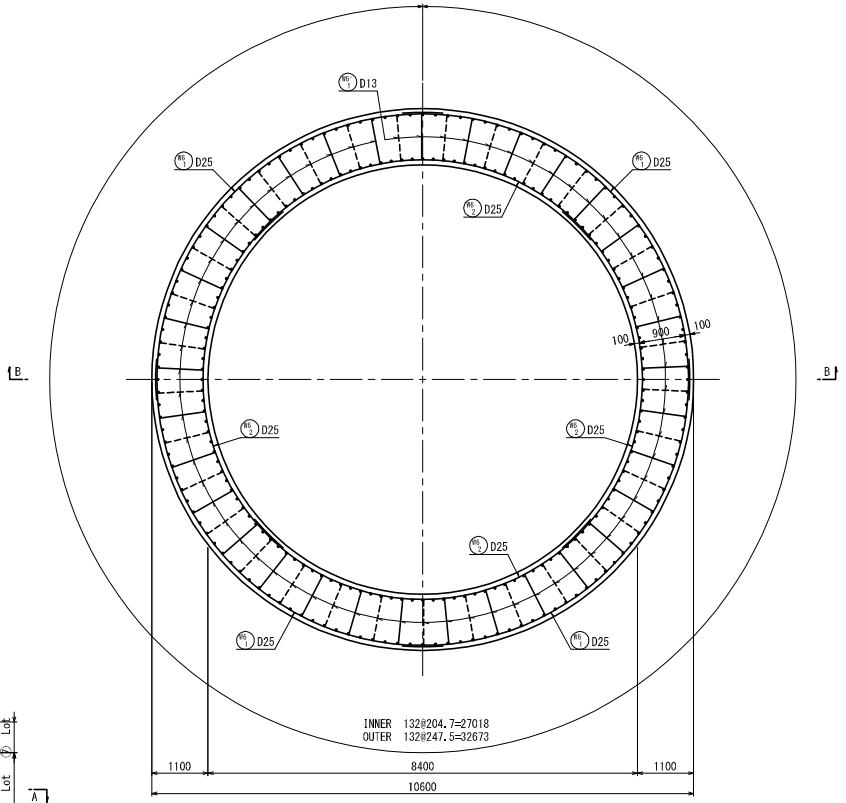
PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT C (16)
DRAWING NO:	RC - 16
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY

DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

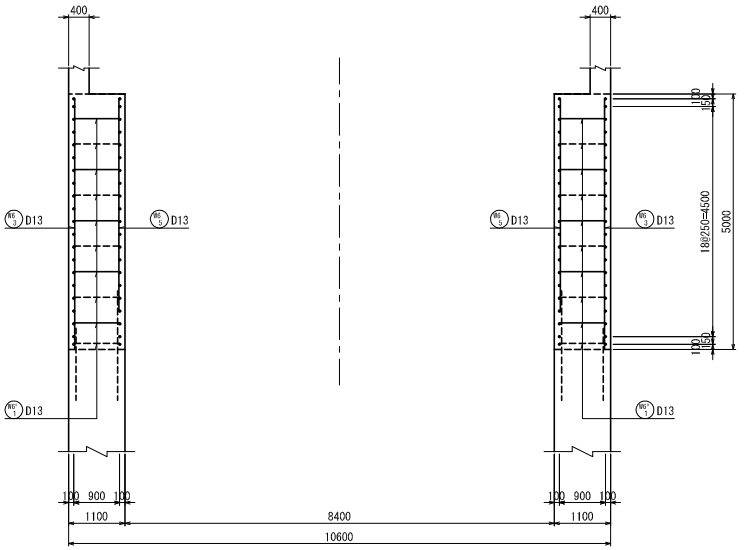
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT C (17) S=1/50

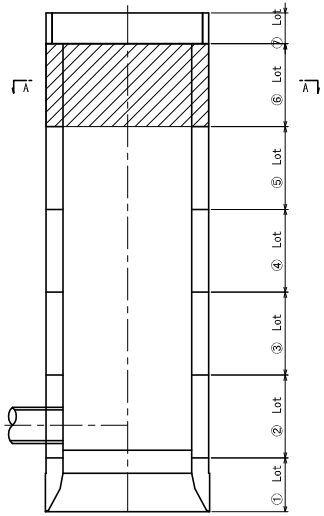
(1ST STEP)



A - A



B - B

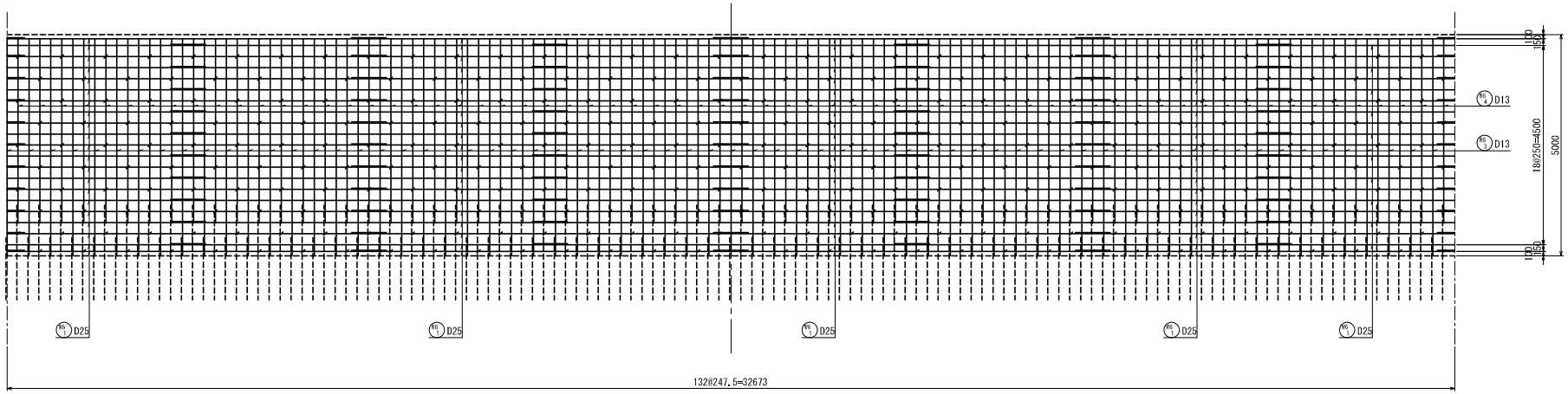


KEY PLAN

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT C (17)		
DRAWING NO:	RC - 17		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	
Japan International Cooperation Agency			

RE-BAR ARRANGEMENT OF SHAFT C (18) S=1/50

(1ST STEP)



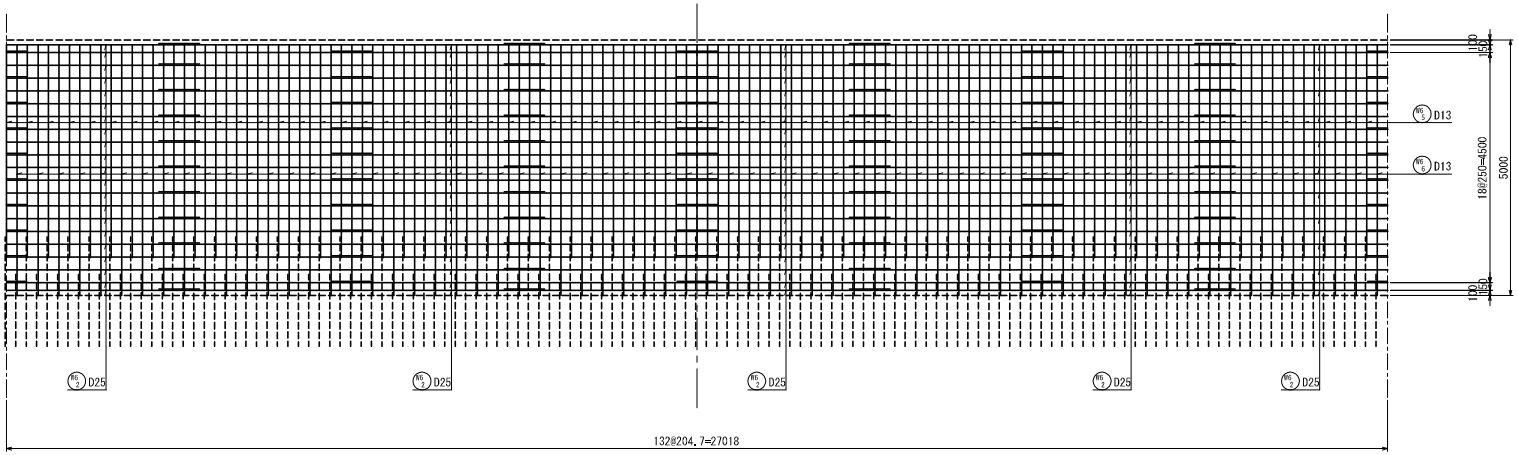
SIDEWALL (OUTER)

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT C (18)		
DRAWING NO:	RC - 18		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT C (19) S=1/50

(1ST STEP)



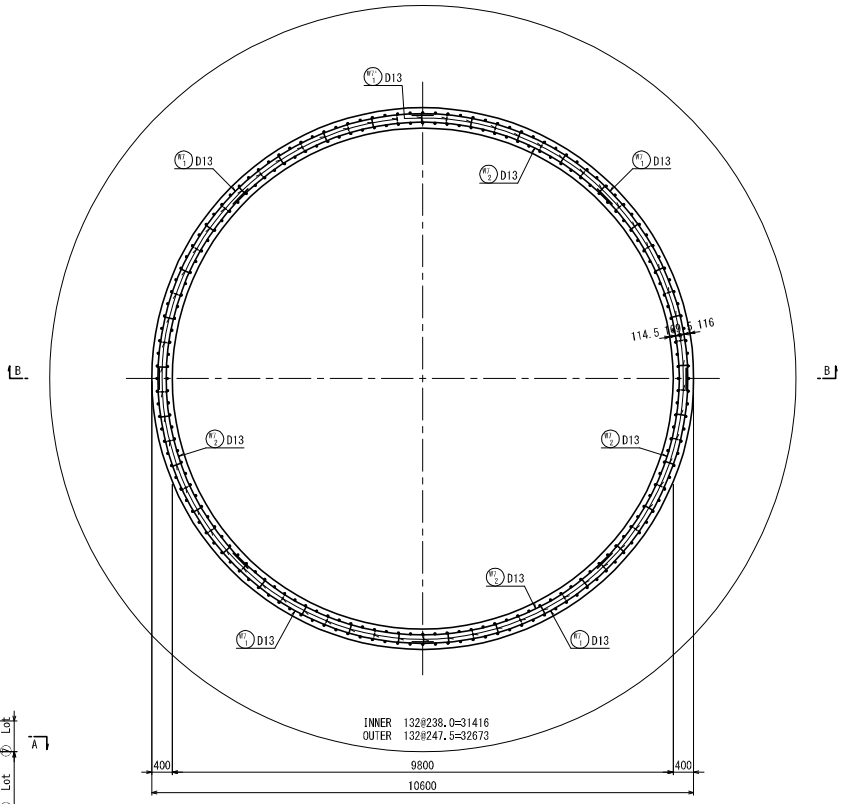
SIDEWALL(INNER)

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT C (19)		
DRAWING NO:	RC - 19		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

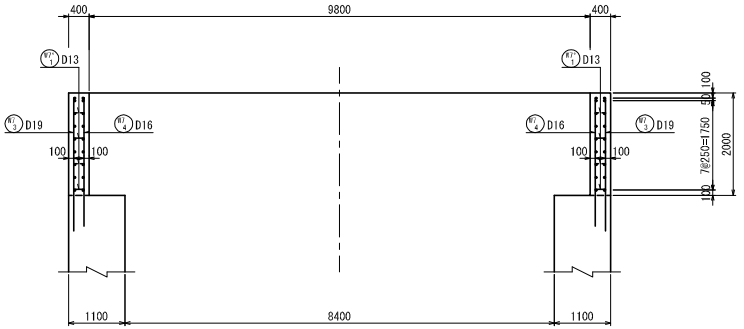
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT C (20) S=1/50

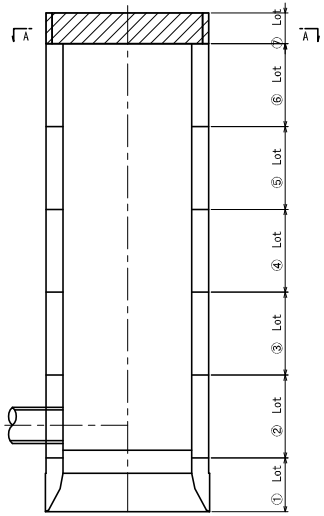
(1ST STEP)



A - A



B - B



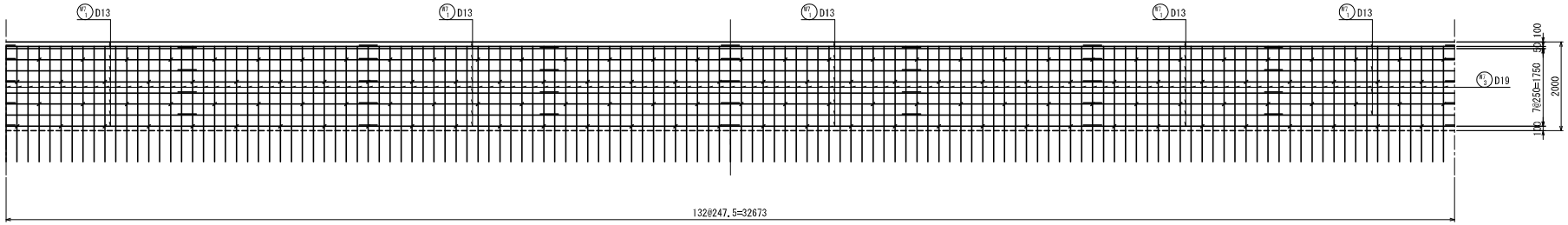
KEY PLAN

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT C (20)
DRAWING NO:	RC - 20
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY
DESIGNED BY:	SHIMAO HIDAKA — DATE:
CHECKED BY:	HARUTOSHI UCHIDA — DATE:

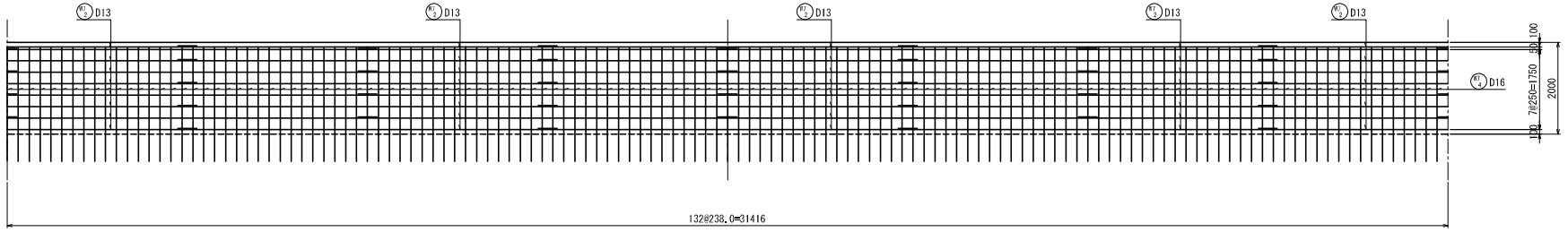
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT C (21) S=1/50

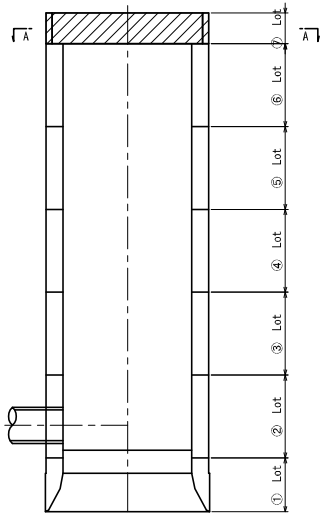
(1ST STEP)



SIDEWALL (OUTER)



SIDEWALL (INNER)



KEY PLAN

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT C (21)
DRAWING NO:	RC - 21
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY
DESIGNED BY:	SHIMAO HIDAKA — DATE:
CHECKED BY:	HARUTOSHI UCHIDA — DATE:

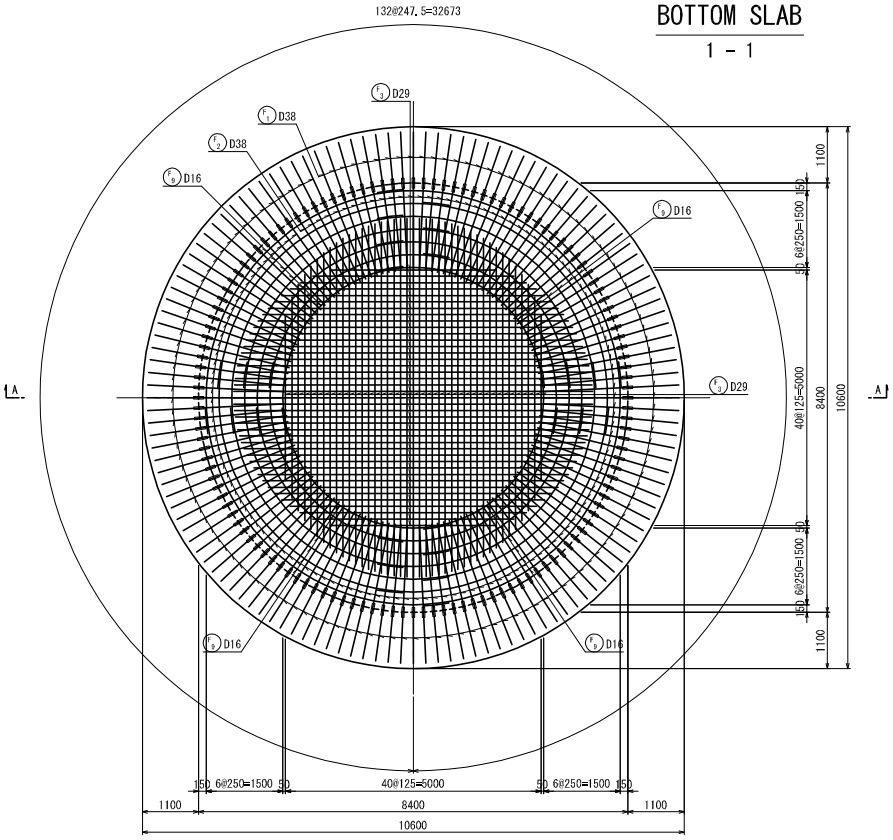
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT C (22) S=1/50

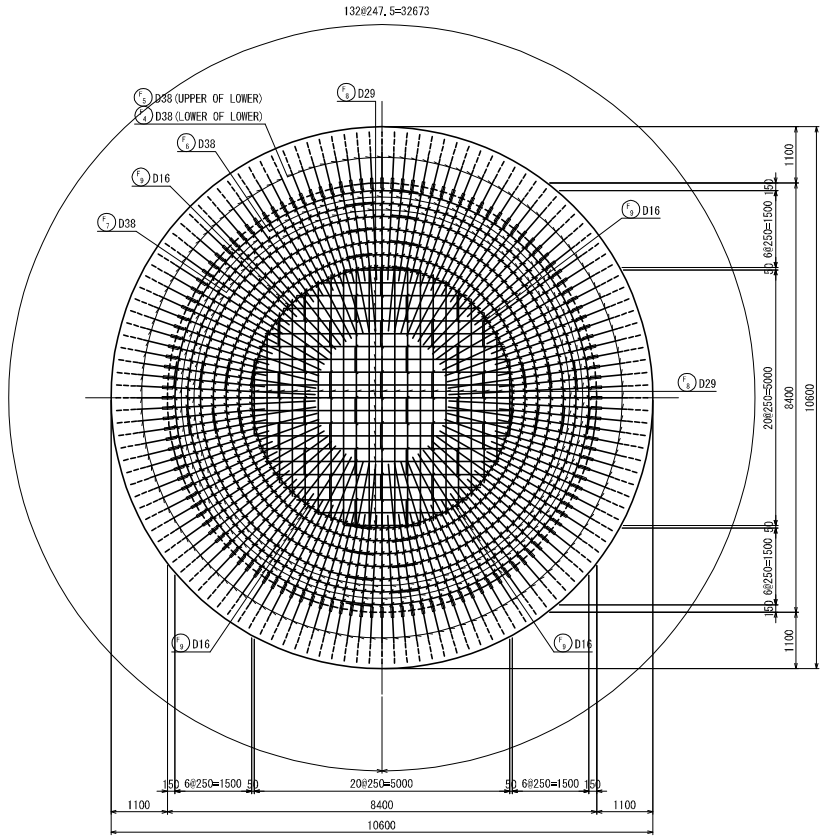
(1ST STEP)

BOTTOM SLAB

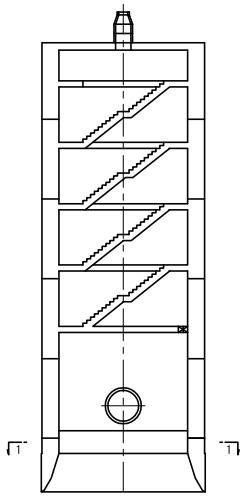
1 - 1



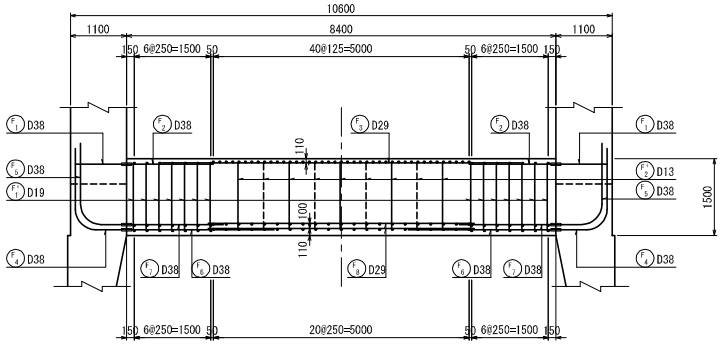
BOTTOM SLAB (UPPER)



BOTTOM SLAB (LOWER)



KEY PLAN



A - A

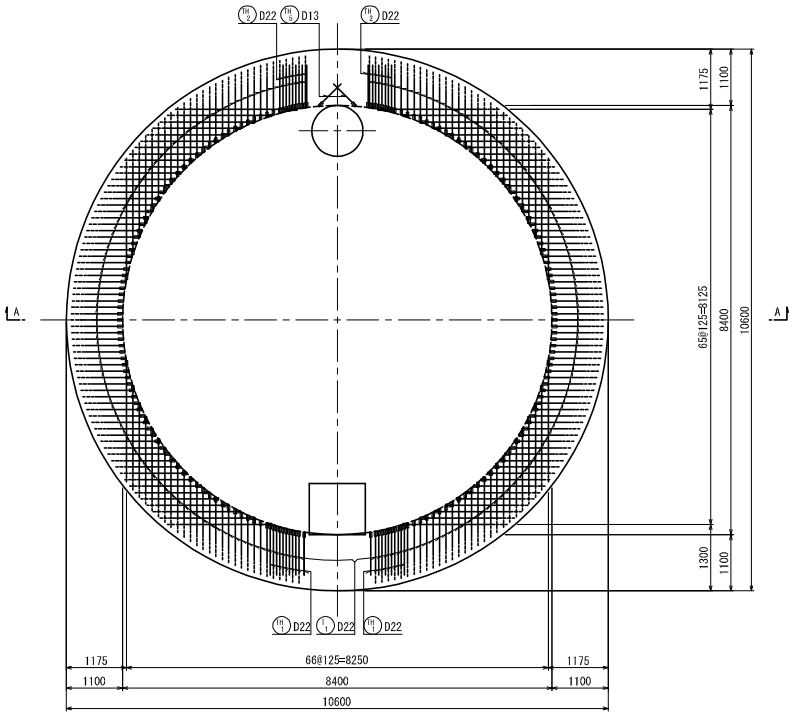
PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT C (22)		
DRAWING NO:	RC - 22		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	
JICA	Japan International Cooperation Agency		

RE-BAR ARRANGEMENT OF SHAFT C (23) S=1/50

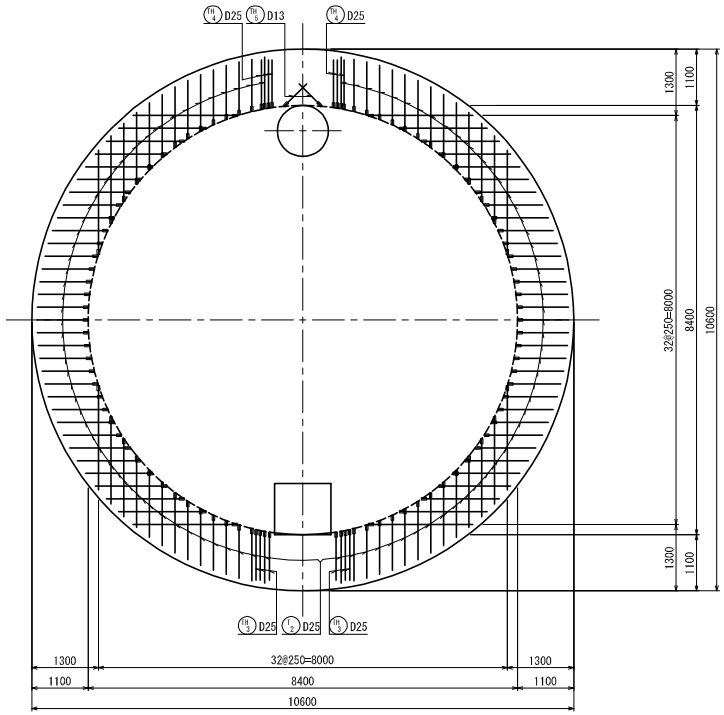
(1ST STEP)

TOP SLAB

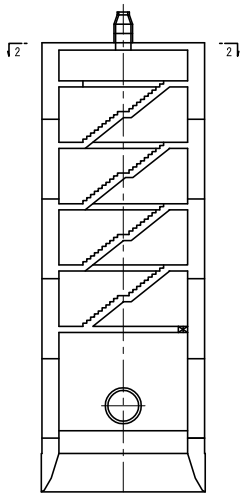
2 - 2



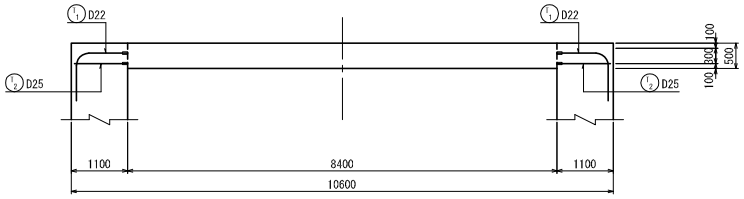
TOP SLAB (UPPER)



TOP SLAB (LOWER)



KEY PLAN



A - A

NOTE:

The structural calculation and the re-bar arrangement shall be reviewed when location and size of openings of slab are determined.

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT C (23)
DRAWING NO:	RC - 23
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY
DESIGNED BY: SHIMAO HIDAKA	DATE:
CHECKED BY: HARUTOSHI UCHIDA	DATE:

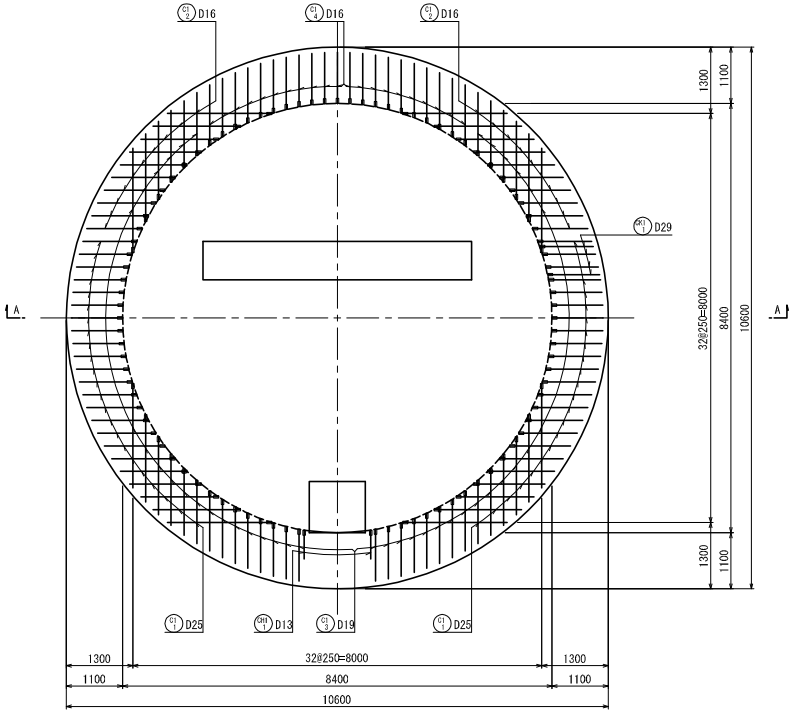
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT C (24) S=1/50

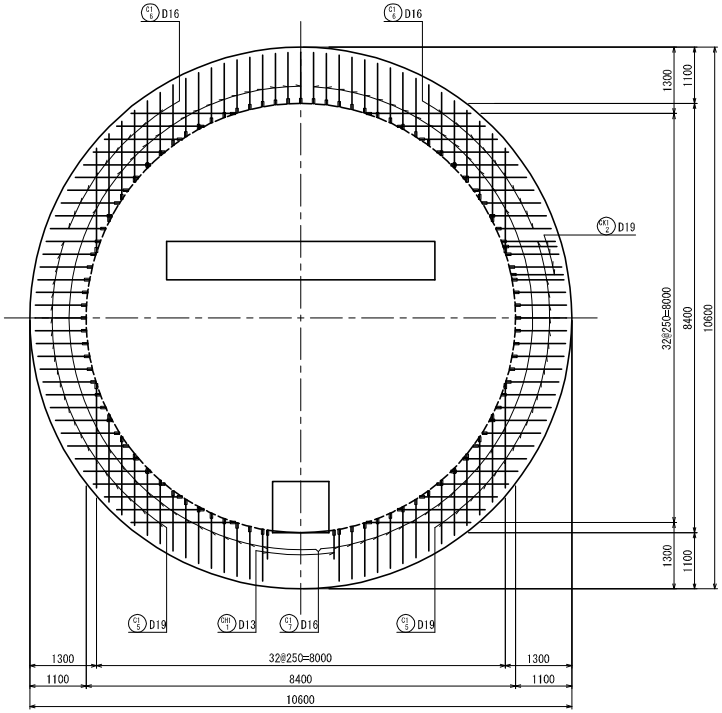
(1ST STEP)

MID SLAB-1

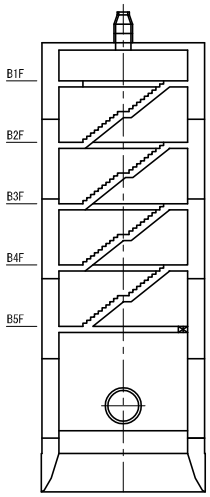
B1F



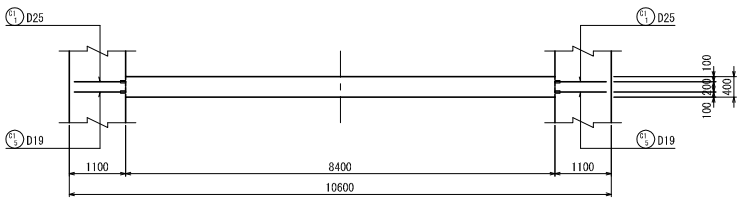
MID SLAB(UPPER)



MID SLAB(LOWER)



KEY PLAN



A - A

NOTE:

The structural calculation and the re-bar arrangement shall be reviewed when location and size of openings of slab are determined.

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT C (24)
DRAWING NO:	RC - 24
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY
DESIGNED BY:	SHIMAO HIDAKA — DATE:
CHECKED BY:	HARUTOSHI UCHIDA — DATE:

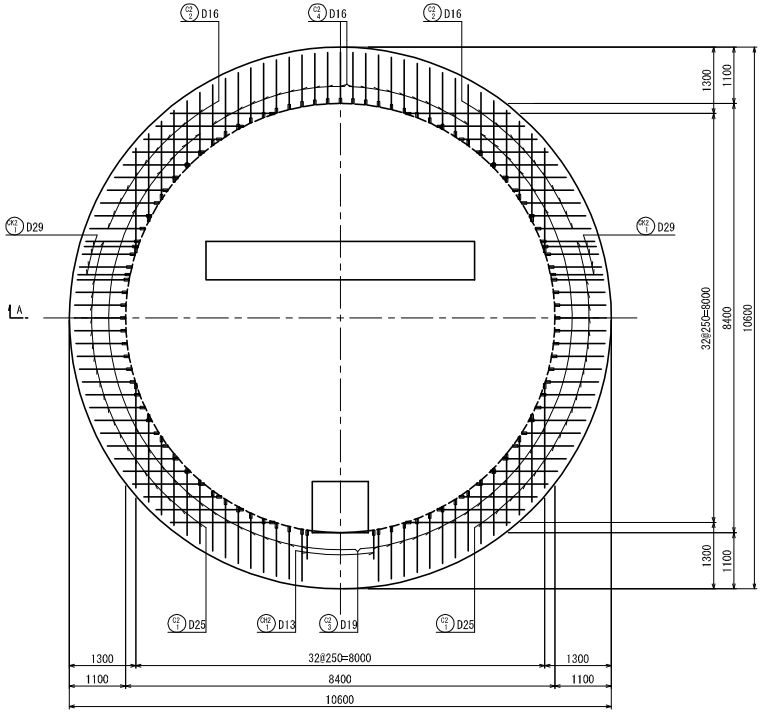
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT C (25) S=1/50

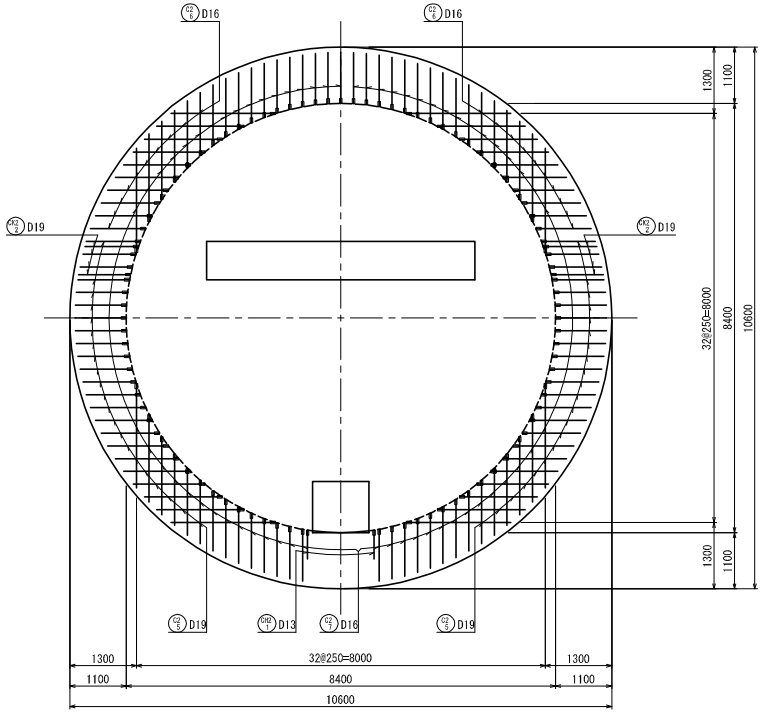
(1ST STEP)

MID SLAB-2

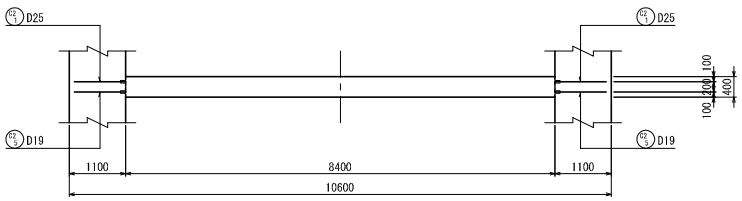
B2F・B3F・B4F



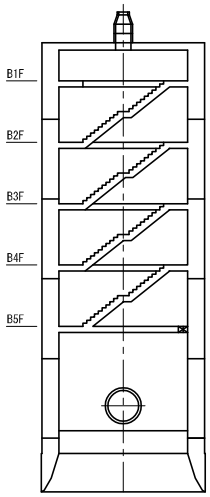
MID SLAB(UPPER)



MID SLAB(LOWER)



A - A



KEY PLAN

NOTE:

The structural calculation and the re-bar arrangement shall be reviewed when location and size of openings of slab are determined.

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT C (25)		
DRAWING NO:	RC - 25		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

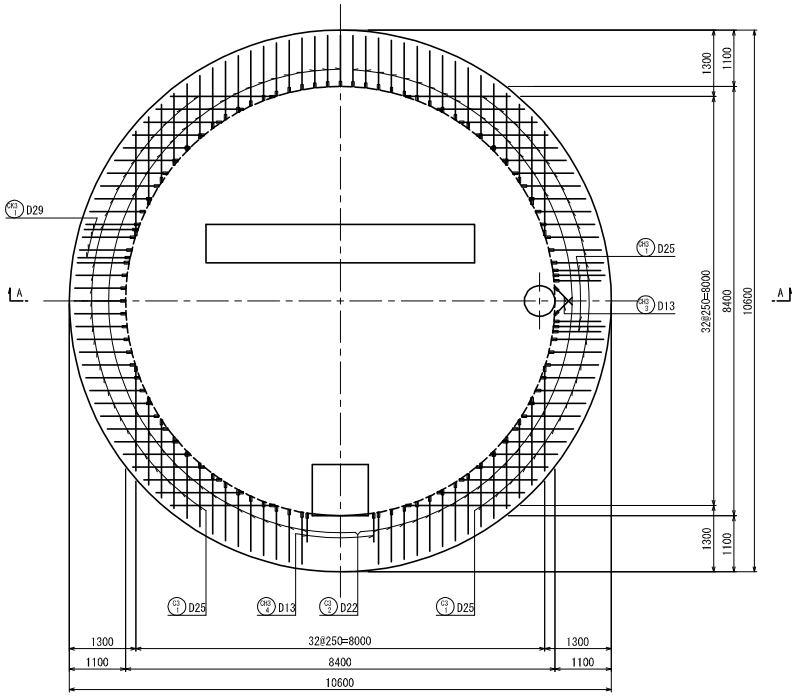
Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT C (26) S=1/50

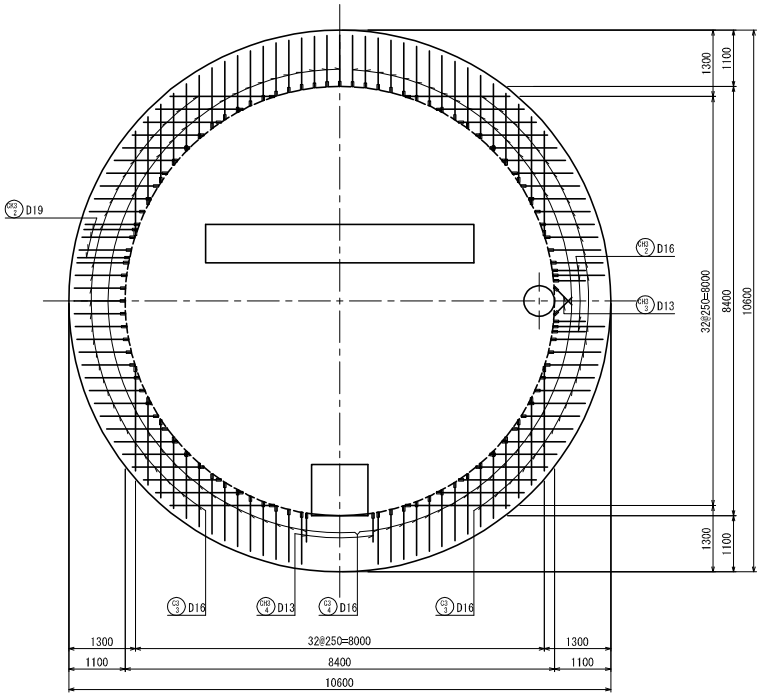
(1ST STEP)

MID SLAB-3

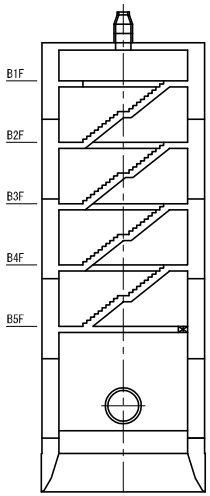
B5F



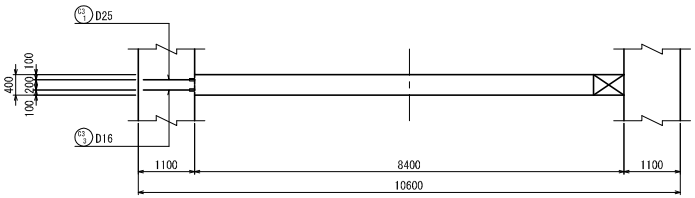
MID SLAB(UPPER)



MID SLAB(LOWER)



KEY PLAN



A - A

NOTE:

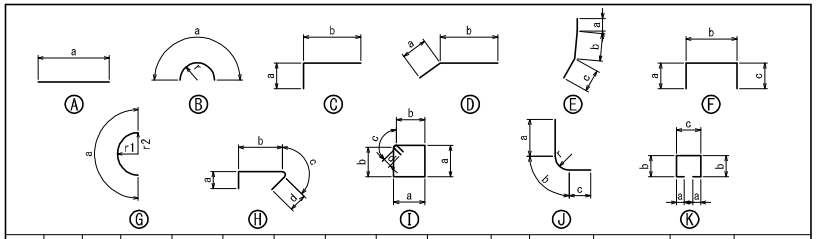
The structural calculation and the re-bar arrangement shall be reviewed when location and size of openings of slab are determined.

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT C (26)		
DRAWING NO:	RC - 26		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT C (27)

(1ST STEP)



No.	SIZE	TYPE	a	b	c	d	r (r1)	r2	LENGTH (mm)	NUMBER	UNIT WEIGHT	WEIGHT/N	WEIGHT (kg)	REMARK
SIDEWALL : ①LOT														
W1 1	D 25	B	8,958				5,200		8,960	20	3.98	35.66	713	
2	D 13	B	8,657				5,250		8,660	36	0.995	8.62	310	
3	D 25	B	7,544				4,300		7,550	16	3.98	30.05	481	
4	D 13	B	7,199 ~8,425				4,322 ~5,103		7,820	36	0.995	7.78	280	(Av. LENGTH)
5	D 22	A	2,480						2,480	66	3.04	7.54	498	
6	D 22	A	3,895						3,900	60	3.04	11.86	712	
7	D 22	A	2,659 ~3,556						3,110	6	3.04	9.45	57	(Av. LENGTH)
8	D 22	C	2,238	928					3,170	132	3.04	9.64	1,272	
9	D 19	D	600	2,903					3,510	59	2.25	7.90	466	
10	D 19	D	600	1,678					2,280	66	2.25	5.13	339	
11	D 19	D	600	1,923 ~2,795					2,960	7	2.25	6.66	47	(Av. LENGTH)
12	D 16	E	500	995	1,542				3,040	132	1.56	4.74	626	
W1' 1	D 13	F	100	938	100				1,140	66	0.995	1.13	75	
2	D 13	F	100	179 ~860	100				720	132	0.995	0.72	95	(Av. LENGTH)

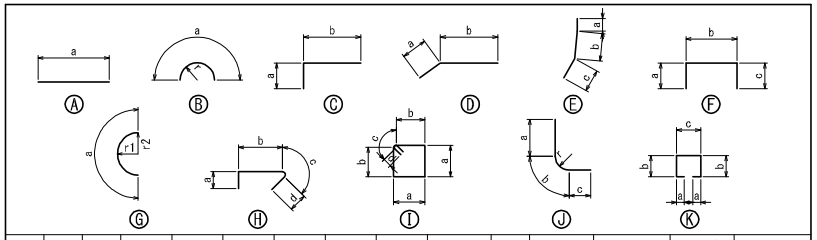
D25	1,194	kg
D22	2,539	kg
D19	852	kg
D16	626	kg
D13	760	kg
TOTAL	5,971	kg

RE-BAR BENDING SCHEDULE

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT C (27)		
DRAWING NO:	RC - 27		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	
Japan International Cooperation Agency			

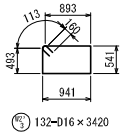
RE-BAR ARRANGEMENT OF SHAFT C (28)

(1ST STEP)



No.	SIZE	TYPE	a	b	c	d	r (r1)	r2	LENGTH (mm)	NUMBER	UNIT WEIGHT	WEIGHT/N	WEIGHT (kg)	REMARK
SIDEWALL : ②LOT														
W2 1	D 25	B	8,958				5,200		8,960	56	3.98	35.66	1,997	
2	D 25	B	8,958				5,200		8,960	12	3.98	35.66	428	
3	D 25	B	7,275 ~7,790				5,200		7,540	10	3.98	30.01	300	(Av. LENGTH)
4	D 25	B	3,212 ~4,365				5,200		3,790	12	3.98	15.08	181	(Av. LENGTH)
5	D 25	B	7,544				4,300		7,550	55	3.98	30.05	1,653	
6	D 25	B	7,544				4,300		7,550	12	3.98	30.05	361	
7	D 25	B	2,478 ~2,996				4,300		2,740	10	3.98	10.91	109	(Av. LENGTH)
8	D 25	B	5,876 ~7,035				4,300		6,460	12	3.98	25.71	309	(Av. LENGTH)
9	D 29	A	5,890						5,890	121	5.04	29.69	3,592	
10	D 29	A	845 ~1,304						1,080	5	5.04	5.44	27	(Av. LENGTH)
11	D 29	A	2,495 ~2,954						2,730	5	5.04	13.76	69	(Av. LENGTH)
12	D 29	A	3,934 ~4,831						4,390	6	5.04	22.13	133	(Av. LENGTH)
13	D 25	A	5,800						5,800	119	3.98	23.08	2,747	
14	D 25	A	861 ~1,339						1,100	6	3.98	4.38	26	(Av. LENGTH)
15	D 25	A	2,421 ~2,899						2,660	6	3.98	10.59	64	(Av. LENGTH)
16	D 25	A	3,630 ~4,502						4,070	7	3.98	16.20	113	(Av. LENGTH)
WH2 1	D 13	A	3,383						3,390	4	0.995	3.37	13	
2	D 13	G	4,436				1,288	1,275	4,440	2	0.995	4.42	9	
3	D 13	A	3,389						3,390	4	0.995	3.37	13	
4	D 13	G	4,446				1,294	1,275	4,450	2	0.995	4.43	9	
W2° 1	D 13	F	100	938	100				1,140	66	0.995	1.13	75	
2	D 16	H	240	113	893	160	48		1,410	1762	1.56	2.20	3,876	
3	D 16	L							3,420	132	1.56	5.34	705	
											D29	3,821 kg		
											D25	8,288 kg		
											D16	4,581 kg		
											D13	119 kg		
											TOTAL	16,809 kg		
SIDEWALL : ③LOT														
W3 1	D 25	B	8,958				5,200		8,960	84	3.98	35.66	2,995	
2	D 25	B	7,544				4,300		7,550	84	3.98	30.05	2,524	
3	D 22	A	5,700						5,700	66	3.04	17.33	1,144	
4	D 22	A	5,335						5,340	66	3.04	16.23	1,071	
5	D 19	A	5,450						5,450	66	2.25	12.26	809	
6	D 19	A	5,700						5,700	66	2.25	12.83	847	
W3° 1	D 13	F	100	938	100				1,140	363	0.995	1.13	410	
											D25	5,519 kg		
											D22	2,215 kg		
											D19	1,656 kg		
											D13	410 kg		
											TOTAL	9,800 kg		

RE-BAR BENDING SCHEDULE



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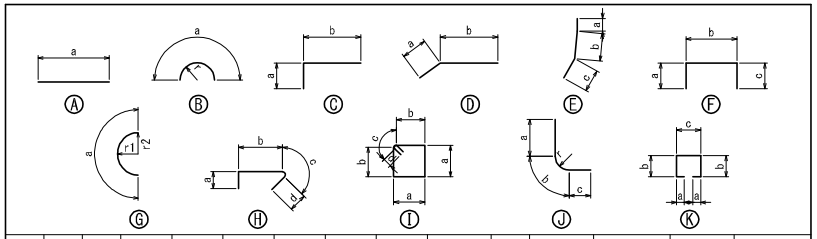
PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT C (28)		
DRAWING NO:	RC - 28		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

Japan International Cooperation Agency

RE-BAR ARRANGEMENT OF SHAFT C (29)

(1ST STEP)



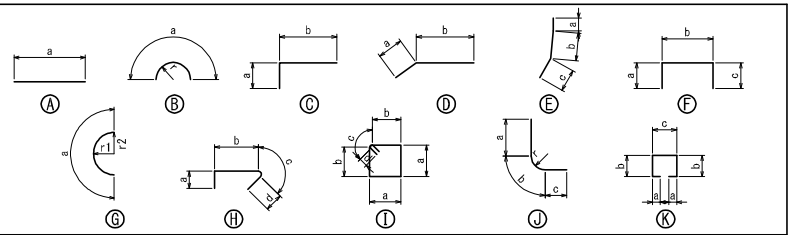
No.	SIZE	TYPE	a	b	c	d	r (r1)	r2	LENGTH (mm)	NUMBER	UNIT WEIGHT	WEIGHT/N	WEIGHT (kg)	REMARK
SIDEWALL : ④LOT														
W4 1	D 25	B	8,958				5,200		8,960	84	3.98	35.66	2,995	
2	D 25	B	7,544				4,300		7,550	84	3.98	30.05	2,524	
3	D 16	A	5,610						5,610	66	1.56	8.75	578	
4	D 16	A	5,370						5,370	66	1.56	8.38	553	
5	D 16	A	5,445						5,450	66	1.56	8.50	561	
6	D 16	A	5,610						5,610	66	1.56	8.75	578	
W4' 1	D 13	F	100	938	100				1,140	363	0.995	1.13	410	
											D25	5,519 kg		
											D16	2,270 kg		
											D13	410 kg		
											TOTAL	8,199 kg		
SIDEWALL : ⑤LOT														
W5 1	D 25	B	8,958				5,200		8,960	84	3.98	35.66	2,995	
2	D 25	B	7,544				4,300		7,550	84	3.98	30.05	2,524	
3	D 13	A	5,610						5,610	66	0.995	5.58	368	
4	D 13	A	5,535						5,540	66	0.995	5.51	364	
5	D 13	A	5,535						5,540	66	0.995	5.51	364	
6	D 13	A	5,610						5,610	66	0.995	5.58	368	
W5' 1	D 13	F	100	938	100				1,140	363	0.995	1.13	410	
											D25	5,519 kg		
											D13	1,874 kg		
											TOTAL	7,393 kg		
SIDEWALL : ⑥LOT														
W6 1	D 25	B	8,958				5,200		8,960	84	3.98	35.66	2,995	
2	D 25	B	7,544				4,300		7,550	84	3.98	30.05	2,524	
3	D 13	A	4,900						4,900	66	0.995	4.88	322	
4	D 13	A	4,165						4,170	66	0.995	4.15	274	
5	D 13	A	4,165						4,170	66	0.995	4.15	274	
6	D 13	A	4,900						4,900	66	0.995	4.88	322	
W6' 1	D 13	F	100	938	100				1,140	330	0.995	1.13	373	
											D25	5,519 kg		
											D13	1,565 kg		
											TOTAL	7,084 kg		

RE-BAR BENDING SCHEDULE

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT C (29)		
DRAWING NO:	RC - 29		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	
Japan International Cooperation Agency			

RE-BAR ARRANGEMENT OF SHAFT C (30)

(1ST STEP)



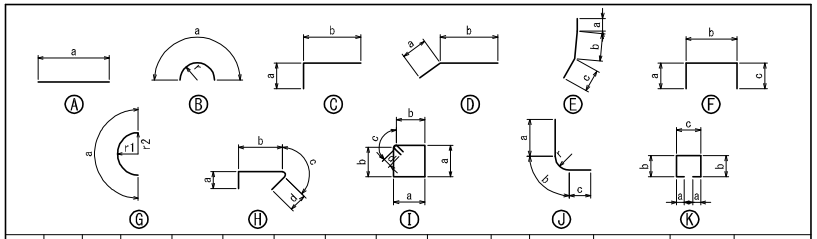
No.	SIZE	TYPE	a	b	c	d	r(r1)	r2	LENGTH(mm)	NUMBER	UNIT WEIGHT	WEIGHT/N	WEIGHT(kg)	REMARK
SIDEWALL : ⑦LOT														
W7 1	D 13	B	8,578				5,200		8,580	36	0.995	8.54	307	
2	D 13	B	8,264				5,000		8,270	36	0.995	8.23	296	
3	D 19	A	2,600						2,600	132	2.25	5.85	772	
4	D 16	A	2,500						2,500	132	1.56	3.90	515	
W7' 1	D 13	F	100	231	100				440	132	0.995	0.44	58	
											D19	772 kg		
											D16	515 kg		
											D13	661 kg		
											TOTAL	1,948 kg		
BOTTOM SLAB														
F 1	D 38	A	1,000						1,000	132	8.95	8.95	1,181	(M.S.)
2	D 38	A	1,700						1,700	132	8.95	15.22	2,009	(M.S.)
3	D 29	A	3,248 ~7,020						5,140	82	5.04	25.91	2,125	(Av.LENGTH)
4	D 38	J	1,190	628	600		400		2,420	132	8.95	21.66	2,859	(M.S.)
5	D 38	J	1,190	628	500		400		2,320	132	8.95	20.76	2,740	(M.S.)
6	D 38	A	2,890						2,890	132	8.95	25.87	3,415	(M.S.)
7	D 38	A	1,890						1,890	132	8.95	16.92	2,233	(M.S.)
8	D 29	A	1,428 ~5,200						3,320	84	5.04	16.73	1,405	(Av.LENGTH)
9	D 16	B	4,506 ~6,862				2,550 ~4,050		5,690	84	1.56	8.88	746	(Av.LENGTH)
F' 1	D 19	H	285	1,280	134	190	57		1,890	924	2.25	4.25	3,927	
2	D 13	K	100	1,322	542				3,390	37	0.995	3.37	125	
											D38	14,437 kg		
MECHANICAL SPLICE(M.S.) NUMBER D38 396 UNIT											D29	3,530 kg		
											D19	3,927 kg		
											D16	746 kg		
											D13	125 kg		
											TOTAL	22,765 kg		
TOP SLAB														
T 1	D 22	J	690	377	760 ~2,136		240		2,520	246	3.04	7.66	1,884	(Av.LENGTH) (M.S.)
2	D 25	A	1,000 ~2,042						1,530	122	3.98	6.09	743	(Av.LENGTH) (M.S.)
TH 1	D 22	A	841 ~1,000						920	12	3.04	2.80	34	(Av.LENGTH) (M.S.)
2	D 22	A	833 ~927						880	10	3.04	2.68	27	(Av.LENGTH) (M.S.)
3	D 25	A	841 ~991						970	6	3.98	3.86	23	(Av.LENGTH) (M.S.)
4	D 25	A	933 ~969						960	6	3.98	3.82	23	(Av.LENGTH) (M.S.)
5	D 13	A	615						620	4	0.995	0.62	2	(M.S.)
											D25	789 kg		
MECHANICAL SPLICE(M.S.) NUMBER D25 134 UNIT											D22	1,945 kg		
D22 268 UNIT											D13	2 kg		
D13 4 UNIT											TOTAL	2,736 kg		

RE-BAR BENDING SCHEDULE

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT C (30)		
DRAWING NO:	RC - 30		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	
JICA	Japan International Cooperation Agency		

RE-BAR ARRANGEMENT OF SHAFT C (31)

(1ST STEP)



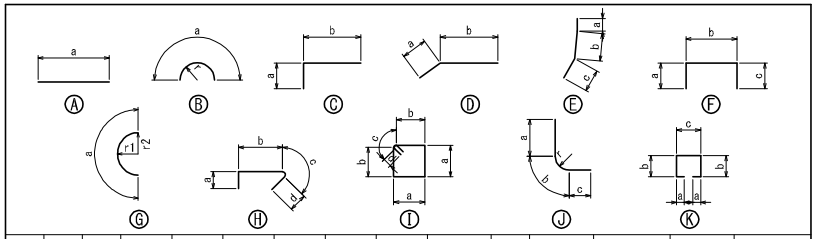
No.	SIZE	TIPE	a	b	c	d	r (r1)	r2	LENGTH (mm)	NUMBER	UNIT WEIGHT	WEIGHT/N	WEIGHT (kg)	REMARK
MID SLAB-1 (B1F)														
C1 1	D 25	A	1,000 ~2,042						1,530	44	3.98	6.09	268	(Av. LENGTH) (M.S.)
2	D 16	A	1,079 ~2,042						1,560	20	1.56	2.43	49	(Av. LENGTH) (M.S.)
3	D 19	A	1,013 ~2,042						1,530	40	2.25	3.44	138	(Av. LENGTH) (M.S.)
4	D 16	A	1,000 ~1,185						1,100	21	1.56	1.72	36	(Av. LENGTH) (M.S.)
5	D 19	A	1,000 ~2,042						1,530	44	2.25	3.44	151	(Av. LENGTH) (M.S.)
6	D 16	A	1,079 ~2,042						1,560	20	1.56	2.43	49	(Av. LENGTH) (M.S.)
7	D 16	A	1,000 ~2,042						1,530	61	1.56	2.39	146	(Av. LENGTH) (M.S.)
CH1 1	D 13	A	561						570	4	0.995	0.57	2	(M.S.)
CK1 1	D 29	A	1,017 ~1,048						1,040	4	5.04	5.24	21	(Av. LENGTH) (M.S.)
2	D 19	A	1,017 ~1,048						1,040	4	2.25	2.34	9	(Av. LENGTH) (M.S.)
									MECHANICAL SPLICE (M.S.) NUMBER	D29	4 UNIT	D29	21 kg	
										D25	44 UNIT	D25	268 kg	
										D19	88 UNIT	D19	298 kg	
										D16	122 UNIT	D16	280 kg	
										D13	4 UNIT	D13	2 kg	
												TOTAL	869 kg	
MID SLAB-2: PER ONEUNIT (B2F~B4F)														
C2 1	D 25	A	1,000 ~2,042						1,530	42	3.98	6.09	256	(Av. LENGTH) (M.S.)
2	D 16	A	1,079 ~2,042						1,560	20	1.56	2.43	49	(Av. LENGTH) (M.S.)
3	D 19	A	1,013 ~2,042						1,530	40	2.25	3.44	138	(Av. LENGTH) (M.S.)
4	D 16	A	1,000 ~1,185						1,100	21	1.56	1.72	36	(Av. LENGTH) (M.S.)
5	D 19	A	1,000 ~2,042						1,530	42	2.25	3.44	144	(Av. LENGTH) (M.S.)
6	D 16	A	1,079 ~2,042						1,560	20	1.56	2.43	49	(Av. LENGTH) (M.S.)
7	D 16	A	1,000 ~2,042						1,530	61	1.56	2.39	146	(Av. LENGTH) (M.S.)
CH2 1	D 13	A	561						570	4	0.995	0.57	2	(M.S.)
CK2 1	D 29	A	1,017 ~1,048						1,040	8	5.04	5.24	42	(Av. LENGTH) (M.S.)
2	D 19	A	1,017 ~1,048						1,040	8	2.25	2.34	19	(Av. LENGTH) (M.S.)
									MECHANICAL SPLICE (M.S.) NUMBER	D29	8 UNIT	D29	42 kg	
										D25	42 UNIT	D25	256 kg	
										D19	90 UNIT	D19	301 kg	
										D16	122 UNIT	D16	280 kg	
										D13	4 UNIT	D13	2 kg	
												TOTAL	881 kg	

RE-BAR BENDING SCHEDULE

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA		
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT C (31)		
DRAWING NO:	RC - 31		
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY		
DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	
Japan International Cooperation Agency			

RE-BAR ARRANGEMENT OF SHAFT C (32)

(1ST STEP)



No.	SIZE	TIPE	a	b	c	d	r (r1)	r2	LENGTH (mm)	NUMBER	UNIT WEIGHT	WEIGHT/N	WEIGHT (kg)	REMARK
MID SLAB-3 (B5F)														
C3 1	D 25	A	1,000 ~2,042						1,530	61	3.98	6.09	371	(Av. LENGTH) (M.S.)
2	D 22	A	1,000 ~2,042						1,530	61	3.04	4.65	284	(Av. LENGTH) (M.S.)
3	D 16	A	1,000 ~2,042						1,530	61	1.56	2.39	146	(Av. LENGTH) (M.S.)
4	D 16	A	1,000 ~2,042						1,530	61	1.56	2.39	146	(Av. LENGTH) (M.S.)
CH3 1	D 25	A	909 ~933						930	4	3.98	3.70	15	(Av. LENGTH) (M.S.)
2	D 16	A	619 ~643						640	4	1.56	1.00	4	(Av. LENGTH) (M.S.)
3	D 13	A	488						490	4	0.995	0.49	2	(M.S.)
4	D 13	A	561						570	4	0.995	0.57	2	(M.S.)
CK3 1	D 29	A	1,017 ~1,048						1,040	4	5.04	5.24	21	(Av. LENGTH) (M.S.)
2	D 19	A	1,017 ~1,048						1,040	4	2.25	2.34	9	(Av. LENGTH) (M.S.)

MECHANICAL SPLICE (M.S.) NUMBER			
D29	4 UNIT	D29	21 kg
D25	65 UNIT	D25	386 kg
D22	61 UNIT	D22	284 kg
D19	4 UNIT	D19	9 kg
D16	126 UNIT	D16	296 kg
D13	8 UNIT	D13	4 kg
		TOTAL	1,000 kg

TOTAL NUMBER OF MECHANICAL SPLICE		TOTAL WEIGHT OF RE-BAR	
D38	396 UNIT	D38	14,437 kg
D29	32 UNIT	D29	7,519 kg
D25	369 UNIT	D25	33,769 kg
D22	329 UNIT	D22	6,983 kg
D19	362 UNIT	D19	8,417 kg
D16	614 UNIT	D16	10,154 kg
D13	28 UNIT	D13	5,938 kg
TOTAL	2,130 UNIT	TOTAL	87,217 kg

RE-BAR BENDING SCHEDULE

PROJECT:	PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
DRAWING TITLE:	RE-BAR ARRANGEMENT OF SHAFT C (32)
DRAWING NO:	RC - 32
CONSULTANTS:	NIHON SUIDO CONSULTANTS NIPPON KOEI CITY OF KITAKYUSHU ORIENTAL CONSULTANTS WATER AGENCY

DESIGNED BY:	SHIMAO HIDAKA	DATE:	
CHECKED BY:	HARUTOSHI UCHIDA	DATE:	

Japan International Cooperation Agency

SUMMARY OF BILL OF QUANTITIES

Project Name: Pilot Project of Sewerage System Development in DKI Jakarta

Location: DKI Jakarta
Work Period : 2016-2017-2018 (24months)

Exchange rate 1JPY= IDR

BILL No.	DESCRIPTION	AMOUNT		
		FOREIGN CURRENCY COMPONENT (Yen x 1000)	LOCAL CURRENCY COMPONENT (IDR x 1000)	COMBINED EQUIVALENT TOTAL (IDR X 1000)
1	Preparatory Works	-	-	-
2	Shaft Construction	-	-	-
3	Pipe Installation:	-	-	-
4	Construction of Manhole	-	-	-
	Sub-total	-	-	-
	Contingency (10%)	-	-	-
TOTAL BID SUM		* -	* -	-
Value Add Tax (10%)		**	** -	-
Grand Total		-	-	-

(i) Foreign Currency Component of Total Bid Sum, written in words.
JPY:
(ii) Local Currency Component of Total Bid Sum, written in words.
IDR:
(*) Carry Forward to Bid
(**) Add 10% of the sum of items 1 to 4 inclusive, for both foreign and local currency components
Exchange rate for currency conversion as advised by Employer: 1 JPY = IDR

Project Name: Pilot Project of Sewerage System Development in DKI Jakarta
Location : DKI Jakarta
Work Period : 2015-2016-2017 (24months)

Exchange rate 1JPY= IDR

No.	Item of Works	UNIT	QUANTITY	UNIT RATE		AMOUNT		COMBINED EQUIVALENT TOTAL (IDR X 1000)
				FOREIGN CURRENCY COMPONENT (Yen x 1000)	LOCAL CURRENCY COMPONENT (IDR x 1000)	FOREIGN CURRENCY COMPONENT (Yen x 1000)	LOCAL CURRENCY COMPONENT (IDR x 1000)	
1	Preparatory Works							
1-1	Installation and removal of Site Sign Board (height: 5m , width:	site	3.00					
1-2	Mobilization and Demobilization	LS	1.00					
1-3	Soil Investigation: including Mobilization and Demobilization, Test Boring, Laboratory Tests and Preparation of Report as specified in the specification							
1-3-1	Sewer Line between Shaft-A to Shaft-B	m	40.00					
1-3-2	Sewer Line between Shaft-B to Shaft-C	m	120.00					
	Sub Total-1-3							
1-4	Survey : including Establishment /Construction of BM, Topographical survey, Center line survey, Levelling survey and preparation of Reporting& Drawings as specified in the specification.							
1-4-1	Topographical Survey	ha	5.0					
1-4-2	Line Survey	m	1,000.0					
1-4-3	Leveling Survey	m	1,000.0					
	Sub Total-1-4							
1-5	Clearing and Grubbing: including hauling to designated disposal Area(L=10km)							
1-5-1	Shaft-A site	m2	1,500.00					
1-5-2	Shaft-B site	m2	700.00					
1-5-3	Shaft-C site	m2	1,450.00					
	Sub Total-1-4							
1-6	Demolition and disposal of monument: including hauling to designated disposal Area(L=10km) (Shaft-C area)	LS	1.00					
1-7	Remove and grub large trees and the plantation due to 10 trees as compensation (Shaft-C area)	no.	2.00					
1-8	Transplantation of trees							
1-8-1	Shaft-A site	no.	5.00					
1-8-2	Shaft-C site	no.	7.00					
	Sub Total-1-7							
1-9	Contractor's Temporary Facilities							
1-9-1	Site Office	m2	150.00					
	Sub Total-1							

No.	Item of Works	UNIT	QUANTITY	UNIT RATE		AMOUNT		COMBINED EQUIVALENT TOTAL (IDR X 1000)
				FOREIGN CURRENCY COMPONENT (Yen x 1000)	LOCAL CURRENCY COMPONENT (IDR x 1000)	FOREIGN CURRENCY COMPONENT (Yen x 1000)	LOCAL CURRENCY COMPONENT (IDR x 1000)	
2	Shaft Construction							
2-1	Shaft A							
2-1-1	Earth-retaining work for Prevention of Collapse (Driving and removal of Steel Sheet PILE TypeIII L=8.0m): including material supply and construction)	m	928.0					
2-1-2	Excavation of Shaft by Press in Caisson Construction Method: including hauling to designated disposal Area(L=10km) and all associated works	m3	2,923.00					
2-1-3	Concrete of Wall and Basement (Fc=24N/mm2 with ordinary Portland cement): including supply, placement and formwork	m3	1,085.00					
2-1-4	Underwater Concrete(Fc=30N/mm2 with ordinary Portland cement): including supply and placement	m3	167.00					
2-1-5	Deformed Reinforcing Bars(SD345)of Wall and Basement: including supply, bending and placement	t	83.30					
2-1-6	Concrete cover of Top of the Shaft	set	1.00					
2-1-7	Installation Chain Link Fence (height : 3.0m) : including supply, fabrication and installation	m	60.0					
	Sub Total 2-1							
2-2	Shaft B							
2-2-1	Earth-retaining work for Prevention of Collapse (Driving and removal of Steel Sheet PILE TypeIII L=8.0m): including material supply and construction)	m	656.0					
2-2-2	Excavation of Shaft by Press in Caisson Construction Method: including hauling to designated disposal Area(L=10km) and all associated works	m3	1,072.00					
2-2-3	Concrete of Wall and Basement (Fc=24N/mm2 with ordinary Portland cement): including supply, placement and formwork	m3	418.00					
2-2-4	Underwater Concrete(Fc=30N/mm2 with ordinary Portland cement): including supply and placement	m3	46.00					
2-2-5	Deformed Reinforcing Bars(SD345)of Wall and Basement: including supply, bending and placement	t	40.42					
2-2-6	Demolished Concrete wall Height 2.3m of Top of Shaft : including disposal demolished concrete	m3	17.34					
2-2-7	Sandy Soil Backfill: including supply and placement	m3	66.28					
	Sub Total 2-2							
2-3	Shaft C							
2-3-1	Earth-retaining work for Prevention of Collapse (Driving and removal of Steel Sheet PILE TypeIII L=8.0m): including material supply and construction)	m	928.0					
2-3-2	Excavation of Shaft by Press in Caisson Construction Method: including hauling to designated disposal Area(L=10km) and all associated works	m3	2,815.00					
2-3-3	Concrete of Wall and Basement (Fc=24N/mm2 with ordinary Portland cement): including supply, placement and formwork	m3	1,046.00					

No.	Item of Works	UNIT	QUANTITY	UNIT RATE		AMOUNT		COMBINED EQUIVALENT TOTAL (IDR X 1000)
				FOREIGN CURRENCY COMPONENT (Yen x 1000)	LOCAL CURRENCY COMPONENT (IDR x 1000)	FOREIGN CURRENCY COMPONENT (Yen x 1000)	LOCAL CURRENCY COMPONENT (IDR x 1000)	
2-3-4	Underwater Concrete(Fc=30N/mm2 with ordinary Portland cement): including supply and placement	m3	167.00					
2-3-5	Deformed Reinforcing Bars(SD345)of Wall and Basement: including supply, bending and placement	t	79.97					
2-3-6	Concrete Cover of Top of the Shaft	set	1.00					
2-3-7	Installation Chain Link Fence (height : 3.0m) : including supply, fabrication and installation	m	60.0					
	Sub Total 2-3							
	Sub Total 2							

No.	Item of Works	UNIT	QUANTITY	UNIT RATE		AMOUNT		COMBINED EQUIVALENT TOTAL (IDR X 1000)
				FOREIGN CURRENCY COMPONENT (Yen x 1000)	LOCAL CURRENCY COMPONENT (IDR x 1000)	FOREIGN CURRENCY COMPONENT (Yen x 1000)	LOCAL CURRENCY COMPONENT (IDR x 1000)	
3	Pipe Installation:							
3-1	Sewer Line between Shaft -A to Shaft-B							
3-1-1	Precast Reinforced Jacking Concrete Pipe (2000 dia): including supply and transportation to Site	m	279.93					
3-1-2	Laying of Precast Reinforced Jacking Concrete Pipe (2000 dia): including pipe jacking, hauling of excavation material to designated disposal Area(L=10km) and all associated works	m	279.93					
3-1-3	Soil Improvement for Starting & Finishing Area : including drilling ,material supply and grouting	L	51,549.00					
	Sub Total 3-1							
3-2	Sewer Line between Shaft -C to Shaft-B							
3-2-1	Precast Reinforced Jacking Concrete Pipe (2000 dia): including supply and transportation to Site	m	669.60					
3-2-2	Laying of Precast Reinforced Jacking Concrete Pipe (2000 dia): including pipe jacking, hauling of excavation material to designated disposal Area(L=10km) and all associated works	m	669.60					
3-2-3	Soil Improvement for Starting & Finishing Area : including drilling ,material supply and grouting	L	51,811.50					
	Sub Total 3-2							
	Sub Total 3							

No.	Item of Works	UNIT	QUANTITY	UNIT RATE		AMOUNT		COMBINED EQUIVALENT TOTAL (IDR X 1000)
				FOREIGN CURRENCY COMPONENT (Yen x 1000)	LOCAL CURRENCY COMPONENT (IDR x 1000)	FOREIGN CURRENCY COMPONENT (Yen x 1000)	LOCAL CURRENCY COMPONENT (IDR x 1000)	
4	Construction of Manhole							
4-1	Concrete (Fc=24N/mm2 with ordinary Portland cement): including supply, placement and formwork							
4-1-1	Slab	m3	36.44					
4-1-2	Staircase	m3	9.84					
	Sub Total 4-1							
4-2	Deformed Reinforcing Bars(SD345): including supply, bending and placement	t	6.40					
4-3	Invert Concrete (Fc=16N/mm2 with ordinary Portland cement): including supply, placement and formwork	m3	25.42					
4-4	Mortar finishing t=2cm: including supply and placement	m2	24.20					
4-5	Installation of Reinforced Concrete Manhole Block : including supply and installation.	set	1.00					
4-6	Cast-in-place Concrete Manhole (for maintenance) : including supply, placement , reinforcement and form works.	set	1.00					
4-7	Manhole Cover (RC cover φ600mm) : including supply and installation	set	1.00					
4-8	Manhole Cover (Concrete Cover): including supply and installation	no.	4.00					
4-9	Ladder Rungs: including supply and installation	no.	24.00					
4-10	Rear Guard : including supply , fabrication and installation	set	1.00					
4-11	Stainless-Steel Balustrade(staircase rail and post) : including supply, fabrication and installation	m	134.02					
	Sub Total 4							

PILOT PROJECT
OF
SEWERAGE SYSTEM DEVELOPMENT
IN
DKI JAKARTA

CHAPTER VIII:
TECHNICAL SPECIFICATIONS
AND DRAWINGS

DIVISION II
CIVIL WORKS

October 2014

PILOT PROJECT OF SEWERAGE SYSTEM DEVELOPMENT IN DKI JAKARTA
CHAPTER VIII: TECHNICAL SPECIFICATIONS AND DRAWINGS
DIVISION II- CIVIL WORKS

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DIVISION II: CIVIL WORKS

This Specification shall apply to all Civil Works under the Contract, including those designed by the Engineer and those to be designed by the Contractor.

Section 1- Topographic Survey of Site

1.1 Scope of Work

The Work under this Section to be carried out by the Contractor consists of the Topographic Survey required over the entire Site area, before any work is commenced and during the progress of the Works for construction, measurement and recording purposes.

Requirements are to confirm necessary topographic information for the work in the site such as setting temporary bench marks and confirming the alignment of the pipeline and the location of the shafts.

The detail of the location on the topographic survey by the Contractor is shown in the site among the parties based on the drawings.

Topographic Survey shall be executed to areas. Methods and requirements shall be as specified herein.

Prior to commencement of the Topographic Survey work, the Contractor shall submit the method statements for the Engineer's approval.

1.2 Topographic Survey of Site and Related to Works

Prior to starting execution of any works under the Contract, the Contractor shall conduct a topographic survey of the Site, in accordance with the survey specifications hereunder or required by the Engineer.

The Contractor shall conduct all necessary surveys for the due execution of the Works during the period of construction in accordance with the applicable survey specifications provided in this Section.

Prior to the commencement of actual construction work, the Contractor shall provide temporary benchmarks, at 500 metre intervals, from the national control point and in manner to be approved along and around the site. The Client will indicate the national control point which shall be used.

The Contractor shall establish a benchmark on the Site, in a position free from interference. This shall be checked back to an established datum as required by the Engineer.

GPS reference points have been established in the Project Area.

1.3 Survey Specifications

1.3.1 General

The instruments and tools to be used in the survey shall be checked and calibrated for accuracy and proper performance in advance of the operation and approved by the Engineer where so required.

Field book information shall as a minimum include the name of survey points, date and time of survey, weather, the rating and type of survey instruments and the survey readings.

1.3.2 Traverse Survey

1) Instruments

The principal instruments and tools used in the traverse survey shall comprise transit, theodolite, total station, steel tape, tension-meter and thermometer, tellurometer, poles, etc.

2) Stations

Survey stations shall be fixed at points as directed by the Engineer. Stakes for the station shall be painted white and consecutively numbered.

3) Operation

(i) The Contractor shall exercise special care in using the steel tape under the minimum possible tension and normal temperature to those approved by the Engineer in the field.

(ii) Distance shall be measured twice, and the average value of the two measurements shall be recorded in the field book. The difference between the two measurements shall not be more than 1/10,000 of the average value.

(iii) Horizontal angle observation shall comprise reading of 2 types of angles: "included angle" and "eccentric magnetic bearing angle".

(iv) Horizontal angle shall be measured by "triple angle method" in both clockwise and counter-clockwise directions, and the value of the angle shall be obtained by the following formula:

Triple angle "a_1" (telescope turned clockwise)
= (Reading of vernier A + Reading of vernier B) / 2

Triple angle "a_2" (telescope turned counter-clockwise)
= (Reading of vernier A + Reading of vernier B) / 2

Value of angle "a" = $(a_1 + a_2) / 6$

(v) The triple angle observation shall be made twice each in both clockwise and counter-clockwise directions and each reading shall have an accuracy of 20 seconds.

(vi) The control system of angles and directions shall be such as determined by the Engineer in each case.

(vii) The error of angle measured shall not be more than 30 n seconds, where "n" represents the number of angles.

(viii) Any error of angle measured shall be distributed as follows:

The error shall be distributed among all survey points proportionate to the distance between the points.

4) Calculation

Based on the results of observation, location of each survey point shall be calculated on the following aspects:

Distance, Included angle, Coordinate calculation and any other calculations as deemed necessary by the Contractor.

5) Results and Records

The records and results of survey shall be compiled and prepared in the following manner:

(i) Field book comprising: Field book of distance
Field book of angles

(ii) Calculation book: Distance calculation
Included angle calculation
Coordinate calculation
Area calculation
Other calculations as deemed necessary by the Contractor

(iii) Records of stations:

Traverse network plan: Scale: 1/500 or as directed by the Engineer

1.3.3 Leveling

1) Instruments

The principal instruments and tools used in leveling shall comprise level, leveling rod, and turning plate.

2) Stations

Stations shall be in accordance with the Drawings or as designated by the Engineer.

Leveling shall start from one benchmark and shall end at another, or at the same one.

3) Operation

(i) Leveling shall be carried out by means of round-trip or as directed by the Engineer.

(ii) Observations shall be by sighting recording sighting.

(iii) Stations may be established either at the existing reference points or at any one of the temporary benchmarks.

(iv) Accuracy of observation

- Round-trip error shall not be more than 10 x S mm
  Where S represents the one-way distance in kilometres.
- Closed ring error shall not be more than 10 x S mm
  Where S = Total distance in kilometres.

(v) Leveling rod distance, number of observations and minimum read out value (accuracy)

- Leveling rod distance Maximum 80 metres
- Minimum read-out value 1 millimetre
- Number of observations Sighting-recording-sighting

4) Calculation

Data entered in the field book shall be calculated to obtain the elevation of each point, distance between each-point, difference in elevations between each point, total difference in elevations and the total distance of each line.

5) Results and Records

The results of survey shall be recorded in an orderly manner including such data as location of bench mark, bench mark no., distance between bench marks, elevation of bench mark, type of leveling rod, serial no. and brand of rod, data of survey, weather and surveyor's name.

(i) Field book: Leveling survey log

		Distance survey log
(ii)	Calculation book:	Leveling Distance calculation Other calculations as deemed necessary by the Contractor
(iii)	Layout plan of stations:	Scale as directed by the Engineer

1.3.4 Line Survey

1) General

The main centrelines shall be set out in the field with centre stakes along the main centreline of all road and other facilities at exact locations designated on the Drawing or as directed by the Engineer.

Stakes shall be driven into the ground at intervals of not more than 20metres and numbered consecutively from the starting point.

2) Instruments

The principal instruments and tools used in this survey shall be transit, theodlight, total station tellurometer, steel tape, tension-meter, thermometer and turning plate

3) Stations

Stations shall be the points specified in the Drawings or as directed by the Engineer. Setting of stakes for the stations shall be subject to the Engineer's approval.

4) Operation

(i) The Contractor shall take special care to use the steel tapes under minimum possible tension and normal temperature to that approved by the Engineer in the field

(ii) Distance shall be measured twice, and the average value of the two measurements shall be recorded in the field book. The difference between the two measurements shall not be more than 1/10,000 of the average value.

(iii) Horizontal angle observation shall comprise reading of 2 types of angles: "included angle" and "eccentric magnetic bearing angle".

(iv) Horizontal angle shall be measured by "triple angle method" in both clockwise and counter-clockwise directions, and the value of the angle shall be obtained by the following formula:

Triple angle "a_1" (telescope turned clockwise)
= (Reading of vernier A + Reading of vernier B) / 2

Triple angle "a_2" (telescope turned counter-clockwise)
= (Reading of vernier A + Reading of vernier B) / 2

Value of angle "a" = $(a_1 + a_2) / 6$

(v) The triple angle observation shall be made twice each in both clockwise and counter-clockwise directions and each reading shall have an accuracy of 20 seconds.

5) Calculation

Based on the results of operation, location of each survey point shall be calculated by the following:

Distance, Included angle, Coordinate calculation or any other calculations as deemed necessary by the Contractor.

6) Results and Records

The records and results of survey shall be compiled and prepared in the following forms:

(i) Field book: Distance survey log

Angle survey log

(ii) Calculation book: Distance calculation

Coordinate calculation

Other calculations as deemed necessary by the Contractor

(iii) Main centre lines plan: Scale 1/500 or as directed by the Engineer

1.3.5 Topographical Survey

1) General

Topographical survey shall be to measure and indicate in the Drawings the topography and the natural features of the site, its boundary through centre-line survey, site boundary survey, longitudinal profile leveling, 10m grid survey and cross sectional leveling based on the reference points, to verify other geographical information and for the purpose of works measurement and recording.

2) Instruments

The principal instruments and tools used in this survey shall comprise: transit, theodolite, total station steel tape, tension-meter, thermometer, geometer, tellurometer (if necessary), level, leveling rod, turning plate, plane table, and alidade.

3) Stations

Stations shall be the points designated in the Drawings or as directed by the Engineer, or other points as necessary for the due execution of the topographic survey.

4) Line Survey

The line survey and the route survey to be conducted as part of the topographic survey shall be of the centre-lines of the roads, as well as the main site areas. The methods and accuracy of survey shall be in accordance with the requirements of "Line Survey".

5) Longitudinal Profile Leveling

(i) Longitudinal profile leveling shall be to measure the elevation at the stations and at the points marking the slope changes on the centre-line and prepare the longitudinal section of a perpendicular plane that includes the centre-lines.

(ii) The methods and accuracy of survey shall be in accordance with the provisions of leveling in "Leveling".

(iii) The standard interval between the temporary benchmarks shall be 500 metres.

6) Cross sectional Leveling

(i) The cross sectional leveling shall be performed according to the right angles to the main centre-lines at the stations and at the slope changes of the stations across the centre-line. Also, at each point of the stations and at each change on the cross-sections slope.

(ii) The methods and accuracy of survey shall be in accordance with the requirements of "Leveling".

7) Calculation

Based on the results of operation, the following calculation shall be made to determine the location and elevation of each point:

Distance, Included angle, Coordinate calculation or any other calculations as deemed necessary by the Contractor.

8) Results and Records

The records and data of survey conducted shall be prepared in the following forms:

(i) Field books: Distance survey book
Angle survey book
Leveling field book

(ii) Calculation book: Distance calculation
Coordinate calculation
Elevations calculation
Other calculations as deemed necessary by the Contractor.

(iii) Centre lines plan: To scale1/5000, or as directed by the Engineer

Longitudinal profile and cross sections: in scale as directed by the Engineer.

1.4 Measurement and Rates.

1.4.1 Measurements

Measurements of the topographic survey shall be done according to the Bill of Quantities which stipulate as follows;

a. Topographic survey : area(ha) of the topographic survey

b. Line survey : length of line survey

c. Levelling survey : length of levelling survey

The completion of all surveys means the approval of the survey results by the Engineer.

1.4.2 Rates

Rates of the topographic survey cover the cost of personnel, equipment and others which shall be needed for the implementation and reporting of the topographic survey.

Section 2 – Soil Investigation

2.1 Scope of Work

The Work under this Division to be carried out by the Contractor, consists of the Soil Investigation, which shall be carried out by the Contractor where required or instructed by the Engineer before any work is commenced.

The soil investigation under this Division is required for the Contractor's design and working plan of micro tunnelling method, shaft works and the relating work for the Project. The provision of geotechnical Services shall also be included.

Prior to commencement of the Soil Investigation, the Contractor shall obtain the Engineer's approval for the equipment to be used and the methods of work execution, submitting the Engineer the method statements.

2.2 Geotechnical Engineering Services

The Contractor shall provide all personnel and equipment necessary to carry out site investigation, install and monitor instrumentation for all embankments and land reclamation areas for stability and settlement in accordance with these Specifications.

The Contractor shall provide experienced Geotechnical Engineering staff and all other geotechnical support as required by the Engineer. The general role of the Contractor's geotechnical staff (will be discussed in details with the Engineer) are as follows

a. Carry out site investigations.

b. Install and monitor soil improvement/instrumentation.

c. Carry out all necessary testing.

d. Evaluate observed measurement results.

e. Discuss with the Engineer and review any modifications to design that may be required.

2.3 Soil Investigations

Boreholes, analysis and tests shall be carried out pursuant to the approved method statements as directed by the Engineer. The Contractor shall be responsible for ascertaining the elevation of the ground at these points and the coordinates of the points in relation to the topographic survey carried out by him.

The Contractor shall have available all equipment, materials and labour necessary to carry out additional soil investigations, borings, field and laboratory tests and reports according to Indonesian standards or the equivalent as instructed by the Engineer.

2.3.3 Field Equipment

The Contractor shall provide and maintain on Site for the requisite period, a suitable and well-maintained boring rig, or rigs, with supporting equipment and spare parts. The rig(s) and equipment shall be equipped for carrying out the following types of investigations to the indicated depths, or as directed by the Engineer:

a. Borings to a maximum depth of 40 m.

b. Undisturbed sampling to a maximum depth of 35 m.

c. Standard penetration tests (SPT) to a maximum depth of 40 m.

2.3.4 Borings

Borings shall be made pursuant to the approved method statement as directed by the Engineer. Borings may be advanced by auger, rotary, or wash-boring methods, in accordance with ASTM Guide D420 or ASTM Test Method D1452.

2.3.5 Undisturbed Sampling

1) Undisturbed samples shall be taken in soft to medium clays using a thin-walled tube sampler, and in medium stiff to stiff clays by using a Denson sampler. The diameter of the samples shall be a minimum 73 mm.

2) Two (two) undisturbed samples shall be taken in at each boring as instructed by the Engineer.

3) Samples shall be taken in accordance with ASTM D1587 to avoid disturbance of the samples. The sample tubes shall be properly sealed, and by the end of each working day transported, without disturbance, to the laboratory where they shall be stored in a cool and humid room until they are tested.

2.3.6 Standard Penetration Tests (SPT)

1) Standard Penetration Tests with split spoon sampling shall be performed in all borings by suitable standardized equipment according to the method described in ASTM D1586. The number of blows shall be performed using a free drop hammer and recorded for every 15 cm of penetration of the sampler. Samples shall be placed in plastic bags and transported to the laboratory for classification and other testing as required by the Engineer. The transportation method shall be subject to the approval by the Engineer.

2) SPT's shall be carried out at depth intervals of 1.0 m, or as instructed by the Engineer. Results of SPT's shall be presented on boring logs as agreed with the Engineer.

3) Disturbed samples taken by SPT instructed by the Engineer shall be placed immediately in an airtight container and Samples shall be examined and described by a geotechnical specialist in accordance with ASTM D420 or other equivalent standards.

2.3.7 Groundwater observation

Groundwater level in boreholes shall be measured and recorded every morning before commencement of the day's drilling work and at least 24 hours after the completion of drilling work.

In case when outstanding loss of drilling water or spring-up of groundwater is encountered, its depth shall be recorded accurately and reported to the Engineer as soon as possible.

2.3.8 In-situ Permeability Test

In-situ permeability test shall be conducted at four (4) boreholes: two (2) tests at each borehole in accordance with ASTM D5126 or other equivalent standards.

2.3.9 Laboratory tests

Laboratory tests shall be carried out for all representative disturbed and undisturbed samples collected from the boreholes to determine their basic physical and mechanical properties. The laboratory tests shall be carried out in accordance with the ASTM standards or other relevant standards as directed by the Engineer. The survey items and its quantities shall be proposed by the Contractor based on the Contractor's design and working plan and clearly mentioned in the method statements for the Engineer's review and approval.

The list of survey items on laboratory tests and its standard to be followed are presented in Table 2-1 for the reference.

Table 2-1: List of Laboratory Test

Laboratory Test	Standard of Test	Quantity
Particle Size Distribution	JIS A 1204 or the equivalent	16
Unit weight	JIS A 1225 or the equivalent	16
Natural Water Content	JIS A 1203 or the equivalent	16
Liquid limit, plastic limit	JIS A 1205 or the equivalent	16
Specific gravity	JIS A 1202 or the equivalent	16
In-situ Permeability	ASTM D5126 or the	8
Unconfined compression test	JIS A 1216 or the equivalent	8
Unconsolidated undrained triaxial compression test	JGS 0521 or the equivalent	8

2.3.1012 Recording and Presentation of Tests and Results

1) Field Records

(i) The Contractor shall record all measurements and relevant observations in the field on standard logs pursuant to the approved method statement. approved by the Engineer. The boring logs shall be filled out successively and handed over to the Engineer by the end of each day in two copies. The boring logs shall show the following information:

- Date and name of Inspector/Engineer
- Boring number and location by co-ordinates
- Reference elevation
- Type of boring
- Water level observed in borehole or in casing
- Standard penetration test data
- Description of soil/rock strata encountered
- Depth of all soil/rock boundaries
- Size, type and depth of samples, and sample numbers
- Type, depth, and recordings of in-situ tests
- Recovery ratios of samples
- Description of samples
- Notes on boring procedures, casing sizes and resistance to driving or coring
- Any irregularities during boring or testing
- Specification of delays, breakdowns or standby

2) Presentation of Test Results

The Contractor shall submit all test results to the Engineer, in a format to be agreed, within two days of tests being completed. In addition the results will be presented in graphical form and digital form on a disk:

3) Report

Within 14 days of the completion of the Site Investigation works, the Contractor shall submit to the Engineer, four copies of a draft report. This report shall include all details of work and findings, including the test procedures, results of all in-situ and laboratory tests, boring logs, photographs, interpretation of the results and the Contractor's

comments.

Within 7 days of receiving the Engineer's comments on the draft report, the Contractor shall submit to the Engineer 10 copies of the final report incorporating the Engineer's comments.

2.4 Measurements and Rates

2.4.1 Measurements

Measurements of the Soil Investigation shall be done by meter (m) of the length of boring subject to the completion of all tests in the site and laboratory required in this Clause and stipulated in the approved method statement. The completion of all tests means the approval of the test results by the Engineer.

2.4.2 Rates

Rates of the Soil Investigation covers the cost of the personnel, the machinery and the material for the implementation of the soil investigation in the site, the laboratory and the office.

Section 3 – Earth-retaining Wall for Prevention of Collapse

3.1 Scope of Work

The work under this Section to be carried out by the Contractor consists of the execution and completion of Steel Sheet Piling for the Earth-retaining wall for Prevention of Collapse.

Earth-retaining wall for Prevention of Collapse shall be provided as indicated on the Drawings.

Earth-retaining wall for Prevention of Collapse shall include the provision and installation of steel sheet piles, driving, cutting and splicing, welding, location, dimension and line, designated in the Drawings for other works and as specified herein.

Prior to commencement of the Steel Sheet Piling works, the Contractor shall secure the Engineers approval of the method statements covering the equipment and materials to be used and the method of work execution.

Particular care shall be taken in the execution of Piling to ensure that no vibration is caused to other structures, buildings or areas including canals and dykes. If in the Contractor's or the Engineer's opinion there is a risk of damage being so caused the Contractor shall modify the methods for Piling at his own expense, and obtain the Engineer's approval thereof.

In the above connection the term "driven piling" shall also be understood to mean "hydraulically jacked piling" and the relevant clauses of this Specification referring to driving piles shall be substituted by alternative methods and procedures proposed by the Contractor and approved by the Engineer for hydraulically jacking piles or installing by other approved methods.

3.2 Materials

3.2.1 Requirement of the Meterials

Steel Sheet piles Type III shall be applied for the work as indicated in the drawings and shall comply with JIS A 5523 or the equivalent. The steel of the sheet pile shall comply with JIS A 3101 or the equivalent. The Contractor shall submit the shop drawings with the material certificate for the review and approval of the Engineer.

3.2.2 Storage and Handling

a. All piles shall be stored and handled in such a manner as shall not inflict any twist, bend, warp, buckle or other damage upon the piles.

b. The piles shall be stored under cover or in the open air on a flat horizontal base laid to falls. Each pile shall be supported on wooden spacers of not less than 100x100 mm cross-section at not more than 2 m centers. The spacers shall be in vertical alignment. The piles shall not be stacked more than 2 m in height.

c. All other Materials shall be stored under cover.

3.3 General Requirements

3.3.1 Submittals

Prior to the commencement of piling operations the Contractor shall submit to the Engineer, for his approval, a method statement giving details of proposed piling methods including:

a. Details of Contractor's Equipment.

b. Method, programme and procedures of pile installation

c. Methods of avoiding damage to adjacent utilities and structures.

d. Anticipated ground vibration, ground movement and methods of monitoring and instrumentation.

e. Arrangements for pile testing.

3.3.2 Obstruction

If, during the execution of the piling, the Contractor encounters obstructions in the ground, he shall notify the Engineer and shall submit to the Engineer details of the method, which he proposes to adopt to overcome the obstruction.

3.3.3 Damage and Nuisance

The Contractor shall carry out the piling without causing damage to the Works, other property or things and underground services. The Contractor shall carry out the piling as far as practicable without causing nuisance by noise, vibration or the timing or working hours.

Due notice shall be taken of existing structures and services within the zone of influence of the Works. The Contractor shall inspect these with the Engineer prior to the commencement of piling, and provide proposals in respect of protecting these structures and services.

3.4 Setting Out

The Contractor shall set out the alignment, the line and level of the pile positions and structures and establish benchmarks and profiles to indicate the lines and levels for works construction. All benchmarks and profiles etc. shall be effectively protected until the permanent works are completed.

Contiguous and steel sheet piles shall be installed in the position shown on the Drawings within a tolerance of ± 60 mm.

At the commencement of installation, the pile, or the relevant equipment governing alignment shall be made vertical to a tolerance of within 1 in 100. The maximum deviation of the finished pile from the vertical shall be not more than 1 in 120 when visible and 1 in 80 when not visible.

In exceptional circumstances where the above tolerances are difficult to achieve, tolerances may be relaxed by the Engineer, subject to consideration of the implications of such action.

Piles, which are out of alignment more than the permitted tolerances, shall be pulled out and re-driven. No correction by force shall be made unless the method statement is approved by the Engineer.

3.5 Placing

Piles shall be set out as shown on the Drawings to the required accuracy and such that straight lines of piling are obtained with full contact along the pile walling, truly vertical. Each steel sheet pile shall be interlocked with the adjoining for its entire length, so as to form a continuous diaphragm throughout the length of each run of pile wall.

The length of pile supplied to be driven in any position and any additional lengths to be added during driving shall be approved prior to the commencement of driving. During the execution of the Works any changes to the supplied lengths shall be subject to the approval of the Engineer.

Under difficult condition of driving, the pile shall be started in a hole or guiding template or by other necessary means to ensure driving in the proper location.

3.6 Driving

Piles shall be driven in a manner as not to subject the piles to damage and for sheet piles to ensure proper interlocking throughout the length of the piles.

At all stages during driving the pile shall be adequately supported and restrained by means of temporary wales, other guide structures or temporary supports to ensure that the piles are driven in correct alignment and plumb, and to prevent bending.

If, at any time, the forward or leading edge of the piling wall is found to be out of plumb in the plane of the wall, in excess of the permitted tolerance, then immediate corrective action shall be taken by the Contractor, as approved by the Engineer, to correct the offending pile and ensure the plumb of subsequent piles within the specified tolerance.

Pile hammers shall be of approved sizes and types and shall be maintained in proper alignment during driving operations by use of suitable leads or by guides attached to the hammer.

A protective cap of approved design shall be employed in driving to prevent damage to the tops of the piles.

The driving of each pile shall be continuous until the specified depth and/or resistance or set has been reached or as directed by the Engineer. In the event of unavoidable interruption to driving, the pile will be accepted provided it can be driven to the specified depth/ or resistance or set without damage.

The piles shall wherever possible be driven in panels of 2 or 3 piles. The panels shall be prepared by welding together single sheet piles to form a firm panel, which can be driven as a single unit.

Panels of piles shall be placed in position between the wales before the first piles shall be driven.

Steel sheet piles driven out of interlock with adjacent piles or otherwise damaged shall be removed and replaced by new piles at the Contractor's expense.

3.7 Cutting and Splicing

Spliced piles shall be observed continuously during driving to detect any departure from true alignment of the two parts. If any such departure occurs, driving shall be suspended and the Engineer shall be informed immediately and the Contractor shall submit his proposals for remedial work.

Piles shall extend above the required cut-off elevation. A tolerance of 10 cm above the elevations indicating top elevation will be permitted. The piles shall not have their tops below the elevation shown on the Drawings.

No installed pile shall be allowed to be cut-off at the cut-off level until the Engineer has inspected the installed piles and the corresponding pile driving logs and has approved the pile in writing.

Piles the heads of which have been damaged during driving shall be cut off and extended by splicing on an additional length to permit driving to the required penetration as directed by the Engineer, all at the Contractor's expense.

Cut-offs shall become the property of the Contractor and shall be removed from the Site. The Contractor shall trim the tops of piles excessively battered during driving, when directed, at his expense.

Details of splices for piles shall be submitted to the Engineer and be subject to his approval.

Steel sheet piles adjoining spliced piles shall be full length piles.

3.8 Pile Set

At the start of the work in a new area or Section a detailed driving record shall be made over the full length of the first pile and during the last 3 m of subsequent piles until consistency of behavior is established.

The Contractor shall give adequate notice and provide all necessary facilities to enable the Engineer to check driving resistance. A check shall be taken only in the presence of the Engineer unless otherwise approved.

The Contractor shall inform the Engineer without delay if an unexpected change in driving characteristics is noted. A detailed record of the driving resistance over the full length of the nearest available subsequent pile shall be taken if required.

When a final set is being measured, the following requirements shall be met:

a. The exposed part of the pile shall be in good condition without damage or distortion.

b. The helmet, dolly and any packing shall be sound condition.

c. The temporary compression of the pile shall be recorded if required.

Bearing capacity of piles driven to the ultimate resistance specified shall be confirmed by the results of a static loaded test pile or piles.

3.9 Inspection of Piles

The Contractor may be required to pull out certain selected piles after driving, for test and inspection, to determine the conditions of the piles.

Any pile so pulled out and found to be damaged to such extent as would impair usefulness in the structure, shall be removed from the work and the Contractor shall at his own expense furnish and drive a new pile to replace the damaged pile.

Piles pulled out and found to be in satisfactory condition shall be redriven without additional cost to the Engineer.

Piles required to be removed shall be pulled by extractors of suitable size and type and by methods approved by the Engineer.

3.10 Records of Work

The Contractor shall keep records, as indicated in the following table, of the installation of each pile and submit two signed copies of these records to the Engineer not later than noon of the next working day after the pile was installed. The signed records shall form a record of the work in accordance with Table 3– 1:

Table 3 - 1: Records

Data, Records and Information to be Kept: Steel and Steel Sheet Piles
Contract
Pile reference number (Location)
Pile type
Nominal cross section dimensions
Length of performed pile
Standing ground water level
Date and time of driving, re-driving or boring
Ground level at pile position (commencing surface)
Working level of piling machine

Depth from ground level to pile toe
Toe level
Pile head level as constructed
Pile cut-off level
Type, weight, drop and mechanical condition of hammer and equivalent information for other equipment
Number and type of packings used during driving
Type and condition of dolly used during driving
Sets taken at intervals during the last 3 m of driving
Temporary compression of pile and ground from time of marked increase in driving resistance until pile reached its final level
Driving resistance taken at regular intervals over the last 3 m of driving
Soil samples taken and insitu tests carried out
All information regarding obstruction delays and other interruptions to the sequence of work

3.11 Measurements and Rates

3.11.1 Measurements

The Earth Retaining Wall for Prevention of Collapse is measured by the meter (m) of the driven/removed steel sheet piles. The length of the steel sheet pile, which is not driven in the soil layer or cut shall excluded from the measured amount.

3.12.1 Rates

The rates of the Earth Retaining Wall for Prevention of Collapse covers the labour, the machinery and the materials of driving, removing, splicing and cutting of sheet piles including the temporary works such as the guide for driving sheet piles.

Section 4 - Excavation

4.1 Scope of Works

4.1.1 The work under this Section to be carried out by the Contractor, consists of the execution and completion of Excavation to all required areas of the Site.

4.1.2 Excavation shall include supports to sides, working space, disposal of all water (including surface water and ground water), segregation of material suitable for backfilling or embankment, all necessary handling, stockpiling, disposal, shaping and trimming completed excavation in accordance with the locations, lines, levels, grades and dimensions shown on the Drawings and as specified herein.

4.1.3 Excavation includes general oversite excavation to reduce levels and particular excavation for below ground structures or from design finish grade including foundations, bases, retaining walls, ditches, culverts and the like.

4.1.4 Prior to commencement of Excavation, the Contractor shall obtain the Engineer's written instructions regarding work area and depth limits, and approval for the equipment and materials to be used and the method of work execution.

4.1.5 All materials arising from Excavation shall remain the property of the Employer and the Engineer will direct the Contractor where the permanent remaining surplus of materials are to be transported and deposited. Materials generally shall be set aside for re-use, or transported and deposited by the Contractor to locations on the Site or within the Project Area.

4.1.6 Where instructed by the Engineer that materials are not required to be retained by the Employer, materials shall be removed by the Contractor from the Site and from the Project Area to a disposal area to be selected by the Contractor, at the expense of the Contractor.

4.2 Construction Methods

4.2.1 Excavation

1) The working methods and equipment used for Excavation shall take into account the nature of soils to be encountered, and the presence of the ground water table.
2) The Contractor is to provide all necessary means for dewatering excavations and maintaining them free of all water, including ground water or storm water.
3) Excavation shall be performed carefully to avoid overbreak or unnecessary disturbance of adjacent surfaces. Any overbreak or disturbance caused by excavation operations shall be backfilled and restored by the Contractor at his expense and as directed by the Engineer.
4) When unsuitable material is excavated below normal sub-grade level the void so formed shall be backfilled with suitable material, compacted in 20cm layers to 90% of its maximum dry density to the approval of the Engineer.
5) Slopes in excavations shall be formed and maintained to prevent the formation of standing water. All excavations shall be finished to reasonably smooth and uniform surfaces.
6) Water from excavations shall not be permitted to flow directly into the new drains or other construction work.
7) Where pumping is necessary, the material in and around the excavations shall not be disturbed by pumping, and all slumps shall be formed clear of excavations for permanent work.

8) Temporary drains shall be built as excavation progresses.

9) The drainage network for the water coming from the work area, whether on or outside the Site, shall be permanently protected against pollution, maintained and kept clean until the end of work.

10) The Contractor shall divert as required all ditches, field drains, foul drains, sewer, water and electrical mains, ducts, etc. wherever encountered during the progress of the work. Where such diversions are temporary the Contractor shall subsequently reinstate them to the Engineer's approval.

11) All excavated grades shall be kept well drained at all times with no storm water standing on the surface and protected as necessary to avoid deterioration.

12) Any cave-in caused by slides or other forces shall be restored by the Contractor at his own expense.

13)

4.2.2 Disposal of Unsuitable or Surplus Excavation Material

1) All other excavated materials, either within or beneath the design excavation limits, that do not meet the specification for embankment material or are liable, in the opinion of the Engineer, to be detrimental to the permanent works shall be designated "unsuitable material".

2) All disposal sites provided and used by the Contractor shall comply with the relevant laws and regulations concerning the Protection of the Environment.

3) Unsuitable or surplus material, shall only be removed from the Site to the Project Area following the written instruction of the Engineer.

4.3 Quality Control and Construction Tolerances

4.3.1 The dimensional tolerance for finished lines, grades and formations after excavation shall be ±5cm of dimensions shown on the Drawings.

4.3.2 Construction works adjacent to an existing road or structure shall be planned in such a way as to ensure the safety of existing facilities and the new construction works. All necessary temporary works and diversions provided by the Contractor shall be adequate for their purpose and comply with relevant regulations of the affected authorities.

4.3.3 The Contractor shall be completely responsible for the selection of method and for the stability of excavations and supports to sides.

4.4 Measurement and Rates

4.4.1 Measurement

1) Excavation

(i) Work under this Section, shall be lump sum (sum) or measured according to the item classifications and units contained in the Bill of Quantities (BOQ). Unless classified otherwise, Excavation shall be measured in cubic metres (m^3).

(ii) The volume of Excavation shall be computed from the direct plan area necessary to accommodate the permanent works, multiplied by the average depth from the designated ground surface level after topsoil removal to the designated sub-grade level indicated on the Drawings or as instructed by the Engineer.

(iii) The volume of any unsuitable material instructed by the Engineer to be excavated

beyond the limits defined above shall be calculated by site measurement or survey at these locations, included in the total volume and paid for as Excavation.

(v) No allowance shall be made in the quantities for bulking or shrinkage.

(vi) No allowance shall be made in the quantities for any additional volume of Excavation or Disposal that may be required to accommodate working space to any excavations, space for earthwork supports or sloping sides of excavations, even if same is indicated on the Drawings.

2) Disposal

(i) Surplus or unsuitable Excavation material, which is instructed by the Engineer to be retained in the Employer's permanent stockpiles on Site or within the Project Area, shall be measured separately in cubic metres (m^3).

(ii) Surplus or unsuitable excavation material, which is instructed by the Engineer to be removed off the Site and off the Project Area, shall be measured in cubic metres (m^3).

(iii) The quantity of Excavation material to be removed shall be the difference between the total measured volume of Excavation and the total measured volume of retained suitable Excavation material.

(iv) No allowance will be made in the quantities of retained material or disposal for bulking or shrinkage.

4.4.2 Rates/Sums

1) Rates/sums for Excavation shall include for:-

(i) Reinstating any existing adjacent surface paving or sodding disturbed by the excavation.

(ii) Removal of all water including surface and ground water by whatever means necessary.

(iii) Forming any trial holes to locate existing pipes or cables

(iv) Excavating by hand or machine

(v) Excavating in any material likely to be encountered including all clayey soils, sands, silts, rocks, boulders, paved areas, old foundations.

(vi) All necessary earthwork supports (timber planking and strutting, unbraced or braced, steel sheet piles) and protection to uphold and maintain sides of excavation, adjacent paving or other structures.

(vii) Leveling, grading, trimming, compacting and protecting excavated surfaces.

2) Rates/sums for disposal of surplus Excavation shall include for:-

(i) Additional volume of bulking

(ii) Selecting, setting aside and preserving any material suitable for backfilling

(iii) Multiple handling.

(iv) Fees and charges for tipping outside the Site and outside the Project Area.

Section 5 - Backfilling

5.1 Scope of Work

The work under this Section to be carried out by the Contractor, consists of the execution and completion of Backfill to all required areas of the Site.

Backfill shall include the supply (or production), hauling, all necessary handling, placing and compaction of suitable material from excavation works or granular backfill adjacent to structures, in accordance with the locations, lines, levels, grades and dimensions shown on the Drawings and as specified herein.

Prior to commencement of Backfill, the Contractor shall obtain the Engineer's approval for the equipment and materials to be used and the method of work execution.

The Contractor may propose the combined construction methods with consideration of adjacent work items. However, the proposed construction methods shall ensure efficiency of the works and meet related technical requirement

5.2 Materials

1) Sandy Soil Backfill

The Material for the sandy soil backfill shall meet the requirement presented in Table 5-1. The procurement of the material is responsibility of the Contractor.

Table 5-1: Characteristics for Common Backfill

Test Item	Test Method	Frequency	Standard Value
Maximum particle size	AASHTO T 27	For each source or change of material	Not greater than 75mm
Plasticity Index	AASHTO T 90	For each source or change of material	Not more than 20
Density-Moisture Relationship	AASHTO T180	For each source or change of material	
Field Moisture Content	AASHTO T 191	One test for each completed layer of backfill	Within the range -3% to +1% of OMC
Field Density	AASHTO T 191	One test for each completed layer of backfill	Not less than 90% of Maximum dry Density except backfill in the area of road. On backfill in the area of road, the results of the field density shall meet the regulation of the road.

2) Granular Backfill

The requirement of the characteristics and gradation for granular backfill is presented in Table 5-2 and Table 5-3, respectively.

The Procurement of the material is responsibility of the Contractor.

Table 5-2: Characteristics for Granular Backfill

Test Item	Test Method	Frequency	Standard Value
Maximum particle size	AASHTO T 27	For each source or change of material	Not greater than 50mm
Plasticity Index	AASHTO T 90	For each source or change of material	Not more than 6
Density-Moisture Relationship	AASHTO T180	For each source or change of material	
Field Moisture Content	AASHTO T 191	One test for each completed layer of backfill	Within the range -3% to +1% of OMC
Field Density	AASHTO T 191	One test for each completed layer of backfill	Not less than 90% of Maximum dry Density except backfill in the area of road. On backfill in the area of road, the results of the field density shall meet the regulation of the road.

Table 5-3: Gradation for Granular Backfill

Sieve Size		Percentage by Weight Passing
Standard (mm)	Alternative US Standard	
50	2 inch	100
0.425	No.40	25 – 90
0.075	No.200	0 – 10

5.3 Construction Methods

Materials for backfilling structures shall not be placed, spread or compacted when it is raining, and no compaction shall be carried out if the moisture content of the material is outside the specified limits.

The depth of each layer of backfill from different sources shall be determined by trials, depending on placement location and the type of compaction equipment to be used.

However, the maximum compacted depth of any material used for backfill to structures shall not exceed 30 cm.

Unless other regulations of the structure such as road on the area of backfill specifies requirements, the each layer of backfill shall be compacted to 90% of its maximum dry density.

5.4 Quality Control and Testing

5.4.1 Sandy backfill shall be tested as instructed by the Engineer and comply with the requirements of Table 5-1.

5.4.2 Granular backfill shall be tested as instructed by the Engineer and comply with the requirements of Table5-3.

5.5 Measurement and Rates

5.5.1 Measurement

1) Work under this Section, shall be measured according to the item classifications and units contained in the Bill of Quantities (BOQ). Unless classified otherwise, Backfill to structures shall be measured in cubic metres (m^3).

2) The quantity shall be computed from the direct plan area of the structural foundation multiplied by the depth from the required formation level to the top of structural foundation. The volume of columns, walls and the like shall be deducted.

5.5.2 Rates

The payment item of backfill covers the labour, the material and the machine for the work such as procurement, transportation, backfill, compaction and testing.

Section 6 – Shaft Works (Press-in Caisson Method)

6.1 Scope of Work

This section covers the general and specific requirements for shaft works: namely construction of drive and reception shafts for the microtunneling works including grouting for soil improvement/ stabilization.

Shafts will be constructed by press-in caisson method, which is composed of following procedures:

1) Ground anchor work: Installation of ground anchor by rotary percussion boring machine for obtaining the reaction force during the pressing-in process:
2) Mound work: Ground leveling at formation level, substituting the top soil to sand (approx. 30cm depth), and laying the plate:
3) Cutter head work: Installing the cutter head which was fabricated in factory on the plate:
4) Caisson structure building work: Construction of caisson structure by cast-in place concrete:
5) Press-in preparation work: Installing press-in machine with safety facilities at the levee crown of caisson structure:
6) Press-in work: Excavation inside caisson structure by clamshell and pressing in the caisson structure by hydraulic jack. The inside of caisson structure is filled with water during this procedure for being tolerant with the reaction force:
7) The procedure 4), 5) and 6) will be repeated until the depth of shaft reaches the designed level:
8) Bottom slab work: Leveling of bottom of shaft and casting underwater concrete to built bottom slab of shaft:, and
9) Water removal work: Removing of water inside caisson structure and constructing the bottom slab of manhole by reinforced concrete.

6.2 Working Programme and the method statements

6.2.1 The Contractor shall prepare a Working Programme and the method statements for the works which shall be submitted to the Engineer for review and approval at least twenty eight (28) days prior to commencement of the work. Approval by the Engineer shall not relieve the Contractor of his sole responsibility for the efficiency, reliability and soundness of the method employed in completing the works in a satisfactory manner.

6.2.2 The working Programme and the method statements shall provide comprehensive descriptions of the materials, equipment, construction methods, quality control procedures, and safety measures to be used and shall be supported by materials specifications detailed shop drawings of temporary works and calculations of their structural and functional adequacy. Particular attention shall be given to demonstrate how the Contractor will manage public safety, accommodation of traffic and care of water.

6.2.3 The Contractor shall also carry out the necessary exploration, identification and collection of information about existing utility services and structures and boundary of private lot located in the vicinity of the Works.

6.2.4 The Contractor shall be responsible for obtaining relevant permits from the relevant Authorities such as work permission in the land of relevant Authorities, transplantation of road

tree, use of public utilities, and agreement on the construction time. Copies of all documents shall be submitted to the Engineer.

6.2.5 The working Programme and the method statements which is stipulated in Section 11 in Division I shall adequately address the following items as a minimum requirement.

a. General description of method including any ground improvement measures:

b. Personnel list in charge of the Construction works including specialist subcontractors to be used (if applicable):

c. Size of all materials utilized to the works, working space, stock yard, relating temporary works and the schedule of the works.

d. Specification of material:

e. Mechanical description of any motorized pumping, jacking and other equipment intended for use

f. Existing underground utility services – Treatment at conflict locations and protection of the service in area of influence

g. Shop drawing of the edge of the caisson and the temporary structures utilizing in pressing-in processes:

h. Monitoring method

i. Programmed daily working hours and duration of the operation

j. Health and safety arrangements including a strategy for dealing with noise pollution problems; manual handling; vibration; heat; dust and chemicals; contaminated water and soils; flooding; methane and other atmospheric contaminants; fire and smoke; access and rescue; oxygen deficiency; and working space.

6.3 Environmental Management Plan

6.3.1 The Contractor has to prevent the impact to the neighboring housing regarding land subsidence, ground displacement, noise, vibration, and other wrong phenomena by the construction. Therefore, the Contractor is obliged to monitor these aspects during the construction. The Contractor has to treat and/or dispose the construction waste in accordance with the Indonesian laws and regulations, and Environmental Management Program.

6.3.2 Not less than twenty eight (28) days prior to the commencement of the Work, the Contractor shall submit Environmental Management Plan to the Engineer for review and approval.

6.3.3 The Environmental Management Plan shall provide comprehensive descriptions of the environmental management during the construction including the monitoring plan, and treatment and/or disposal plans of construction waste. Removal or any other works required by the Responsible Entity shall be submitted to the Engineer. The environmental management plan shall adequately address the following items as a minimum requirement.

a. Surface settlement monitoring plan and building structures assessment plan

b. Monitoring and measurement for dealing with noise, vibration, dust and chemicals, contaminated water and soils, and other wrong phenomena

6.4 Safety

The Contractor shall adhere to the safety requirement stipulated in safety regulations with regard to tunneling works and shall take action as shown below.

a. The completed works shall have no features that could be a hazard to workers, supervising staff, inspecting officers or other persons having access to the works.

b. The guards, electrical safety devises, thermal insulation, noise suppression devices, written notices, safety colours etc. shall be provided where necessary.

c. Adequate guards shall be provided to prevent personnel accidents coming into contact with rotating parts, dangerous machinery, mechanisms, hot surfaces, electrically live parts and other hazardous components or contents. Guards shall be rigid, securely fixed and made so that they do not have to be removed during normal operation running maintenance and routine inspection. Such guards may be of wire mesh, extruded metal or other perforated corrosion resistant material. Openings giving access to rotating parts shall be such that the standard test finger when inserted through any opening does not touch any moving part.

d. Where necessary the fixing of guards shall be interlocked with the electricity supply so as to prevent the operation of the machinery except when all guards are in position and fixed. Emergency stop devices shall be provided and positioned adjacent to all driven plant in accordance with the Specification.

6.5 Construction of Shafts

6.5.1 Fabrication of Structure of Caisson

The Contractor shall clean up the surface of seam joint and confirm the horizontality for the pressing-in before pouring concrete.

6.5.2 Pressing - in the Concrete Structure

1) The Contractor shall take time for curing concrete to maintain the necessary strength of the concrete before pressing - in the concrete structure.

2) The Contractor shall propose the complement works to accelerate pressing - in the concrete structure.

3) The Contractor shall control the process of pressing - in the concrete structure monitoring the deformation of the ground, subsidence and inclination of the structure. In case, the progressive trend of the deformation, the subsidence and the inclination were observed, the Contractor shall propose and take counter measure for stopping the progression.

4) The Contractor carrying out pressing-in the concrete structure maintaining the horizontality of the concrete structure by controlling the volume and location of excavation and the pressure of hydraulic jack.

5) At the end of pressing in the lot, the Contractor shall carefully check the horizontality of the structure and adjust the structure to be horizontal. In addition, the contractor shall prevent the caisson structure from sinking with their own load by loading weight equivalent to the next lot of the concrete structure.

6) The instrument of the works shall be well maintained before proceeding the next lot of the concrete structure.

6.5.3 Excavation

1) The Contractor shall propose the excavation method for the condition of the soil layer observed in the site.

2) The Contractor shall propose the necessary complement works to transport the excavated soil for the disposal site for the approval of the Engineer.

3) During the works, the Contractor shall report the Engineer any accident and its risk and sign observed in the site with his countermeasure. The report shall be done through the phone call and in writing.

6.5.4 Ground Anchor

1) The anchor shall be constructed the requirement for the repeatable force of multiple lots of pressing - in process.

2) The ground anchor works shall meet with the requirement stipulated by Japanese Geotechnical Society or Japan Anchor Association.

3) The Contractor shall carry out testing the constructed anchor.

   a. One (1) anchor of the first construction in the site shall be tested with the design load. The design load shall be reputably load and unload at least five times to confirm its stability.

   b. The other anchors shall be tested with the design load to confirm its stability.

   c. The minimum design load is 2,660kN/anchor.

   d. The Contractor shall prepare the report of testing including the pictures to show the procedure of the test.

4) The grout to fix the anchor shall be injected under the pressure from 100 to 500 N/mm^2 and the compressive strength of cement paste of the grout shall meet over or equivalent $18N/mm^2$.

6.5.5 Concrete Work

Concrete of the works shall comply with the reference specification B of Concrete. The particular requirement of the concrete for the work is presented in Table 6-2.

The ready-mixed concrete shall be the product from factory with JIS certification. In case of usage of the product from the factory without JIS certification, the confirmation shall be obtained by the Employer (the Engineer).

a. The specification for concrete is as below, and the tolerance of slump is 2.5 cm.

b. The specification of floor slab of reinforcement concrete for highway bridge is shown hereunder, and slump of 8cm is standardized.

Table 6-2 Particular Requirement of Concrete

Location	Design strength	Slump	Maximum size of coarse aggregate	Water cement ratio (W/C)
Bottom slab, manhole Side wall of press-in caisson	24N/mm2	12	20mm	Less than 55%
Water stop concrete of press-in caisson	24N/mm2	15	40mm	Less than 55%
Invert concrete	18N/mm2	12	20mm	Less than 60%

(Note) In case of usage of crushed stone concrete, the maximum size of coarse aggregate can be changed from 25mm to 20mm by the approval from the Employer (the Engineer).

6.5.6 Reinforcing Steel Bar

Reinforcing steel bar shall meet all requirement mentioned in the reference specifiction C of the reinforcing steel bar.

6.5.7 Form works

Form work shall meet all requirement mentioned in the reference specifiction D of the form work.

6.5.8 Monitoring the Press-in Caisson Method

1) The Objectives of monitoring is to control the deformation of the caisson during the pressing - in and to reflect the result to the safety control of the works.
2) The locations of monitoring shall be discussed and approved by the Engineer.
3) The required items in monitoring are listed, but not limited to the followings.
   a. Caisson
      - Soil pressure with the caisson
      - Water pressure with the caisson
      - Friction force between the caisson and the soil layers
      - Force at the edge of the caisson
      - Internal force of steel bar
      - Subsidence of the caisson
      - Displacement of the caisson
      - Inclination of the caisson with the horizontality
      - Force acted to Anchor
   b. Ground or Soil Layers surrounding the Caisson
      - Pore water pressure
      - Subsidence of the soil layer surrounded the caisson
      - Ground water level in the site
      - Subsidence of the ground in the site
   c. Monitoring for the Building close to the Site
      - Inclination
      - Subsidence
      - Temperature
4) Period of Monitoring and number of times
   a. On the testing of buildings close to the site, the period of monitoring is one month before the works and the period of the works.
   b. The other items shall be carried out during the works and for one month after the works. The number of times shall be mentioned in the method statement for the approval of the Engineer.
   c. Monitoring system

      Monitoring system shall have viewer to check the results immediately after monitoring. All results shall be recorded in electronic device and report in writing. The electronic device for recording the result shall be approved by the Engineer.
   d. Reporting of Monitoring

      The Contractor shall submit report of monitoring before works, during works and after works subject to the request of the Engineer.

e. Evaluation of the Results

The Contractor shall reflect the results to the safety control and quality control. The report of quality control or safety control based on the results of monitoring shall be submitted to the Engineer subject to the request of the Engineer.

6.5.9 Tolerances

1) Shaft works shall be carried out to the following tolerances:

a. Base elevation ▽ : ± 30 mm

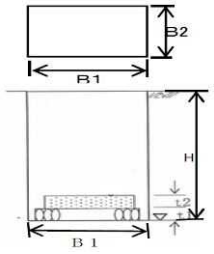
b. Depth (h) : ± 30 mm

c. Clearance (B1 and B2) : ± 100 mm

d. Gravel base thickness (t1) : ± 30 mm

e. Concrete slab thickness (t2) : － 10 mm

f. Inclination of caisson structure: 1/500



2) Tolerance indicated in above sub-clause will be measured at all shafts constructed in the project.

6.6 Drive and Reception Shafts

6.6.1 Prior to the commencement of pipe jacking works, three vertical shafts shall be constructed at the places as shown in the drawings. Out of the three shafts two shafts shall be for pipe jacking operation, in which thrust jacks and related facilities for pipe jacking shall be installed and a cutting shield and concrete pipes shall be thrusted to the reception shaft. The other one shaft shall be constructed for the purpose of receiving the microtunneling shield machine. A guide rail shall be installed in the reception shaft and after completion of jacking works the microtunneling shield machine shall be taken out of the shaft using a crane. These shafts are provided as temporary facilities during pipe jacking operation and after completion of all works, a manhole for maintenance shall be constructed in the shaft. Finally all temporary structures shall be removed.

6.6.2 Drive and reception shafts shall be designed and constructed to allow the safe operation of equipment and handling of materials and to withstand all loadings imposed by ground and groundwater pressure, superimposed loads from surface structures and the maximum anticipated thrust forces. In addition, the proposed site of shafts has high water pressure, the shaft shall be sufficiently measured for the groundwater.

6.6.3 The plant base, which contains equipment, devices and plant machine units required for jacking operation, shall be constructed outside and adjacent to a jacking shaft as shown in the drawings and as approved by the Engineer. A Plant Base will include all works required for the construction of plant base including civil works to fix the plant base foundation, erection and removal of plant facilities such as a grout injection unit, a slurry piping unit, a slurry processing unit, pipe connection works and other miscellaneous works. The Contractor shall be fully responsible for the construction of the plant base, installation of equipment and devices, protection of the base by fence, provision of noise reduction facilities etc., and for the efficient execution of the jacking operation. Since the land space available is limited and located on a traffic road, the Contractor shall be required to make a effective layout design of the plant taking into consideration of such constraints. Full details of his proposals, including plant layout, operation procedures, etc., shall be submitted to the Engineer and shall be to the satisfaction of the Engineer before construction.

6.6.5 In all case the Contactor shall submit his proposals including calculations to the Engineer for approval.

6.6.6 Construction requirements are as follows:

a. The Contractor shall be required to furnish, install and remove concrete thrust wall, or whatever provisions that have been used for backing up the jacks during the pipe jacking. The jacking shaft shall also be equipped with steel rails or beams embedded in concrete. These rails or beams will be used for placement and initial alignment of each pipe during the jacking operation, therefore these shall be constructed so as to have sufficient accuracy and stiffness to maintain the proposed tunnel alignment.

b. The thrust wall (jacking rig reaction surface) shall be normal to the proposed line of thrust and the surface be flat. The thrust wall shall be sufficient to accept repeatedly the maximum allowable jacking force without undue movement.

c. The construction of the thrust wall and any other associated temporary works shall be such as to prevent damage to any part of the permanent works.

d. The Contractor shall take any measures necessary to prevent damage or deterioration of the soil reaction face during the construction of the temporary and permanent works from whatever possible cause, such as ingress of water, softening a cohesive soil or loss of fines from a granular soil.

e. The tunnel entrance structure (exist eye) in a shaft shall be constructed so as to prevent leakage of lubricant, void filling material or groundwater from tunnel side.

f. The Contractor shall take any measures to keep the jacking shaft and especially the tunnel under construction from the ingress of stormwater flowing along the road.

6.6.7 Soil Improvement for Starting & Finishing Area

1) General matter

a. The grouting is implemented for cutting the side wall of starting shaft and prevention of collapse of excavation surface at starting and arrival shafts. The construction work shall be done under the supervision by the experienced engineer.

2) The method, materials and injection scope of grouting are shown hereunder.

a. Method: Dual-tube double-packer grout system

b. Grout material:

First phase grouting: Primary cementitious grout injection

Second phase grouting: liquid and slow settling type inorganic material

3) The grout pipe shall not interfere with pipe jacking machine.

a. The injection scope is mainly the position of starting and arrival shafts and the injection scope shall be proposed to the Engineer in advance and approved by them.

b. The following injection ratio is utilized as reference and the final ratio shall be approved by the Engineer

Clay ; 1^{st} phase injection ratio - 10%, 2^{nd} phase injection ratio - 14%.

Sandy soil ; 1^{st} phase injection ratio - 5%, 2^{nd} phase injection ratio - 26.5%

4) Injection

a. A position of grout pipe shall be checked per hole to keep the design location and depth by construction plan and in case of the difficulty of drilling at design position, consultation with the Engineer is required.

b. In case that uplift of ground or abnormality of structures occurs, injection shall be immediately stopped and appropriate countermeasure shall be made by discussion with the Engineer.

c. The injection should be managed by continuous recording of pressure and flow rate by self-recording meter. In case that big difference between design and actual amounts occurs, discussion with the Engineer is required.

5) Drilling hole

The drilling hole is constructed by a boring machine and the drilling method which affects the ground condition excessively shall not be applied. The drilling hole diameter shall be approximately 100mm and intervals between drilling holes shall be approximately 1.0mm.

6) The completed length of injection can be managed by self-recording meter and also it can be visually confirmed by mixing rod with marking line.

7) Boring survey

A permeability test is implemented on site for the confirmation of the injection effect. The position and time for test is determined by the Engineer.

8) Construction supervision

The construction supervision related to a grouting method is implemented as presented in Table 6-1.

Table 6-1 Construction Supervision

Item	**Content**	**Frequency**
Completed work management by direct measurement	Injection interval (arrangement) Drilling length、Injection elevation	All hole
Completed work management by recording	Injection interval (arrangement), Drilling length, Injection elevation Construction condition	1 hole per 10 hole

6.7 Material

6.7.1 Concrete

Concrete of the works shall comply with the reference specification B of Concrete. The particular requirement of the concrete for the work is presented in Table 6-2.

The ready-mixed concrete shall be the product from factory with JIS certification. In case of usage of the product from the factory without JIS certification, the confirmation shall be obtained by the Employer (the Engineer).

d. The specification for concrete is as below, and the tolerance of slump is 2.5 cm.

e. The specification of floor slab of reinforcement concrete for highway bridge is shown hereunder, and slump of 8cm is standardized.

Table 6-2 Particular Requirement of Concrete

Location	Design strength	Slump	Maximum size of coarse aggregate	Water cement ratio (W/C)

Bottom slab, manhole Side wall of press-in caisson	24N/mm2	12	20mm	Less than 55%
Water stop concrete of press-in caisson	24N/mm2	15	40mm	Less than 55%
Invert concrete	18N/mm2	12	20mm	Less than 60%

(Note) In case of usage of crushed stone concrete, the maximum size of coarse aggregate can be changed from 25mm to 20mm by the approval from the Employer (the Engineer).

6.7.2 Reinforcing Steel Bar

Reinforcing steel bar shall meet all requirement mentioned in Section 10.

6.7.3 Form works

Form work shall meet all requirement mentioned in Section 11.

6.7.4 Anchor Ground

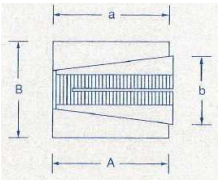
The contractor shall obtain the permission regarding the number and the diameter of prestressing steel strand from the Engineer prior to the commencement of the work.

Prestressing steel strand

Diameter	Nominal cross sectional area mm²	Unit mass kg/ km	Tensile strength		Yield strength		Elongation %	Relaxation losses at 1000hour %		JIS Symbol
			Tensile load kN	Tensile strength N/ mm²	Yield load kN	Yield strength N/ mm²		N	L	
19 strand 21.8mm	312.9	2,482	573	(1,831)	495	(1,581)	3.5	8.0	2.5	SWPR19N SWPR19L

6.7.5 Components for PC steel wire・steel strand wires (Posttensioned grip: AG type)

Diameter	Sleeve		Wedge		Mass (g/unit)
	A mm	B mm	a mm	b mm	
21.8mm(AG-5)	75.0	65.0	75.0	44.5	1,740



6.8 Measurement and Rates

6.8.1 Measurements

Measurement items of the work composed of excavation of shaft by press in caisson, concrete of wall and basement, underwater concrete, deformed reinforcing bars and soil improvement for starting & finishing area.

1) Excavation of shaft by press in caisson

The measurement is carried out with cubic meter(m^3) of the excavated volume by the press in caisson method based on the as-build drawings. The volume of the structure of the shaft shall be excluded from the measurement.

2) Concrete of wall and basement or underwater concrete

The measurement is carried out with cubic meter(m^3) based on the as-build drawings.

3) Deformed reinforcing bars

The measurement is carried out with tons (t) based on the as-build drawings. The weight of the material for fixing and placing the reinforcing steel bar in proper place shall be excluded from the measurement.

4) Soil Improvement for starting & finishing area

The measurement is carried out with liter (L) injected in second phase under the Engineer's approval.

6.8.2 Rates

Rates of excavation of shaft by press in caisson, concrete of wall and basement, underwater concrete, deformed reinforcing bars and soil improvement for starting & finishing area covers following component.

1) Excavation of shaft by press in caisson

The rate covers the labor, the material and the machine for pressing in the shaft including its temporary works and monitoring, ground anchor, excavation.

2) Concrete of wall and basement or underwater concrete

The rate cover the labor, the material and the machine for mix design, trial mix, formwork, temporary works such as supporting and scaffolding, curing and testing concrete.

3) Deformed reinforcing bars

The rate covers the labor, the material and the machine for forming, placing and fixing the deformed reinforcing bars.

4) Soil Improvement for starting & finishing area

The rate covers the labor, the material and the machine for drilling hole, casing, first phase injection and second phase injection.

Section 7 – Microtunneling Works (Pipe Jacking Method)

7.1 Scope of Work

This section covers the scope of the microtunneling work (pipe jacking method). The construction works under the Contract consists but not limited to the following:

- The Contractor shall construct pipelines of the sewerage system using the microtunneling (pipe jacking) method for the pipelines indicated in the Drawings.
- Construction of thrust wall, installation of jacking equipment, sheeting, bracing, etc., and for the efficient execution of the jacking operation. Full details of his proposals, including plant, cutting shield, equipment, operation procedures, jacking shafts and intermediate jacking stations etc.
- Construction of installing pipes by the long-distance and curved microtunneling (pipe jacking) technology.

Excavation shall be carried out by microtunneling shield machine which is capable of maintaining and adjusting alignment as necessary.

The machine and systems shall be designed to provide the forces necessary for the installation of the full pipe string between drive and reception shafts

Provision shall be made for closing up the exposed excavation face at all times.

The construction work of the main sewer in the project is long-distance and curved microtunneling works under the high water pressure. Therefore, followings shall be well managed by the Contractor:

The pipe jacking procedure described in the Contractor's working Programme and the method statements shall be made in full consideration of the ground and groundwater conditions along the pipeline routes and shall be discussed with, and shall have the approval of, the Engineer prior to implementation.

The Contractor shall repair and restore properties damaged by heave, settlement or vibration resulting from his pipe jacking operations to their condition before being disturbed at no cost to the Employer.

7.2 Working Programme and the method statements

The Contractor shall prepare a working programme and the method statements for the work which shall be submitted to the Engineer for review and approval at least twenty eight (28) days prior to commencement of the work. Approval by the Engineer shall not relieve the Contractor of his sole responsibility for the efficiency, reliability and soundness of the method employed in completing the works in a satisfactory manner.

The working Programme and the method statements shall provide comprehensive descriptions of the materials, equipment, construction methods, quality control procedures, and safety measures to be used and shall be supported by materials specifications detailed shop drawings of temporary works and calculations of their structural and functional adequacy. Particular attention shall be given to demonstrate how the Contractor will manage public safety, accommodation of traffic and care of water.

The working Programme and the method statements which is stipulated in Section 10 in Division I shall adequately address the following items as a minimum requirement.

a. General description of method and sequence of operation including any ground

improvement measures

b. Personnel list in charge of the Construction works including specialist subcontractors to be used (if applicable)

c. Jacking pipe type and specification (including certification of water pressure resistance and hydrogen sulfide resistance)

d. Type of joint and specification (including certification of water pressure resistance)

e. Grout and lubricant type, methodology and equipment for injection

f. Mechanical description of any motorized pumping, jacking and other equipment intended for use including microtunneling shield machine and intermediate jacking station

g. Details of the surface establishment including offices and accommodation; equipment layout; pipe storage and handling; crane or gantry; muck handling, storage and spillage prevention; separation or slurry control and management; fencing and hoardings; and security

h. Existing underground utility services – Treatment at conflict locations and protection of the service in area of influence

i. Survey and monitoring equipment of direction, alignment and gradient of jacking pipe, and pressure of cutter face.

j. Direction of installation of pipeline

k. Size, depth and position of required

l. Programmed daily working hours and duration of the operation

m. Health and safety arrangements including a strategy for dealing with noise pollution problems; manual handling; vibration; heat; dust and chemicals; contaminated water and soils; flooding; methane and other atmospheric contaminants; fire and smoke; access and rescue; oxygen deficiency; and working space.

n. Traffic management

o. Dewatering (Muck treatment)

The Contractor shall also carry out the necessary exploration, identification and collection of information about existing utility services and structures and boundary of private lot located in the vicinity of the Works.

The Contractor shall be responsible for obtaining relevant permits from the relevant Authorities such as work permission in the land of relevant Authorities, transplantation of road tree, use of public utilities, and agreement on the construction time. Copies of all documents shall be submitted to the Engineer.

7.3 Environmental Management Plan

The Contractor has to prevent the impact to the neighboring housing regarding land subsidence, ground displacement, noise, vibration, and other wrong phenomena by the construction. Therefore, the Contractor is obliged to monitor these aspects during the construction. The Contractor has to treat and/or dispose the construction waste in accordance with the Indonesian laws and regulations, and Environmental Management Program.

Not less than twenty eight (28) days prior to the commencement of the Work, the Contractor shall submit Environmental Management Plan to the Engineer for review and approval..

The Environmental Management Plan shall provide comprehensive descriptions of the environmental management during the construction including the monitoring plan, and treatment and/or disposal plans of construction waste. Removal or any other works required by the Responsible Entity shall be submitted to the Engineer. The environmental management plan shall adequately address the following items as a minimum requirement.

a. Surface settlement monitoring plan and building structures assessment plan

b. Construction waste (Muck) treatment and disposal; location of temporary muck storage site if proposed; details of haulage equipment, and final disposal site

c. Monitoring and measurement for dealing with noise, vibration, dust and chemicals, contaminated water and soils, and other wrong phenomena

7.4 Safety

The Contractor shall adhere to the safety requirement stipulated in safety regulations with regard to tunneling works and shall take action as indicated in this Clause and Division I.

7.4.1 Ventilation system

1) The air, breathed by persons in underground excavations, shall contain not less than 18 % of oxygen and shall not contain a concentration of contaminants such as gases, vapors and dusts greater than limit, being safe for worker's health, with the regard to the effects of time, temperature, humidity and the combined effects of several contaminants.

2) The Contractor shall monitor content of oxygen (O_2) and other gases, such as carbon dioxide (CO_2), nitrogen oxides (NOx), hydrogen sulfide (H_2S), methane (CH_4), and carbon monoxide (CO) in order to prevent unexpected accident.

3) The monitoring/measuring records shall be submitted to the Engineer on a daily basis. All instruments for the monitoring of gas concentration within the underground excavation shall be provided by the Contractor and shall be regularly calibrated.

7.4.2 Lighting

1) During construction the Contractor shall provide the following lighting requirements:

   a. Working area: not less than 70 Lux

   b. Passage Way: not less than 10 Lux

2) All power and lighting wires and cables shall be adequately insulated and securely installed and regularly checked for damage.

7.5 Surface Settlement

The Contractor shall locate surface settlement markers on a 10m x 10m grid and extending to at least 10m on either side of the centerline of the pipeline or as agreed with the Engineer.

Observations shall be carried out at intervals to be agreed with the Engineer. In the event of settlement or heave of any marker, the Engineer shall be informed immediately and work shall cease until action has been taken, with the agreement of the Engineer, to prevent further settlement or heave.

The Contractor shall provide a pre-construction and post-construction assessment of the buildings, structures and roads within 30 meters of the centerline of the proposed pipelines, thrust and reception pits.

The assessment shall include a photographic record of the structures near the alignment before and after construction, particular attention being paid to any preexisting damage to the structures. The contractor shall provide the Engineer with copies of the photographs.

The photographs shall be taken with a camera having the facility to record the date of photographs taken in the prints and digital data.

The initial surface settlement measured directly above the front face of the cutting shield during the tunnelling operations does not exceed 50 mm, and the maximum surface settlement after the tail voids are grouted shall not exceed 100 mm. Subsequently, the ground shall be reinstated to the original level.

7.6 Site layout

The site shall be laid out to facilitate the supply of pipes, the removal of construction waste (muck) and allow easy disconnection and extension to the services with the addition of each jacking pipe to the pipeline in the drive shaft.

Provision shall be made for the suitable handling of fuel, oils and chemicals and for barriers or methods of containment to ensure that there is no loss of fuel, oil or chemicals to drains or waterways or contamination of the ground.

7.7 Microtunneling Shield Machine

The microtunneling shield machine shall have an enough strength to resist the external forces and to maintain the safety working condition.

The thrust jacks shall be fixed at the back of the concrete thrust wall in the jacking shaft together with jacking frame. Furthermore in conjunction with the above main jacks, intermediate jacks, which will be fixed between two concrete pipes, shall be utilized depending on the required thrust length between the drive shaft and the reception shaft. The required number and thrust capacity of jacks shall be determined on the basis of the soil properties, tunnel diameter and tunnel length between the above two shafts. In the same way the required number and the capacity of the intermediate jacks shall be determined.

The Contractor shall submit the detailed information regarding the cutting shield and jacks, detailed specifications and the calculation basis to determine the required machine types, numbers and capacities in the Working Programme and the method statements.

7.8 Pipe Jacking Operation

Jacking pipes shall not be used without the approval of the Engineer. Cut pipes shall not be jacked.

The jacking force applied by thrust jack or an intermediate jacking station shall not exceed the design allowable distributed or deflected load for any pipe being jacked.

Jacking forces shall be transferred to pipes through a thrust ring which shall be sufficiently rigid to ensure even distribution of the load.

Intermediate jacking stations shall be inserted no later than when the jacking force by main thrust jack reaches an agreed level, typically 66% of the pipe design load or 66% of the available jacking thrust, whichever is the lesser, unless otherwise agreed with the Engineer during the jacking operation.

Angular deflection measured at the deflection between the longitudinal axes of two adjacent pipes shall not exceed 0.5^{o}. If the angular deflection exceeds the permitted 0.5^{o}, the deviated pipe is required to be replaced to the correct alignment before proceeding with the drive

further. Or else the drive be allowed to continue with the approval of the Engineer to an approved alignment and level with a lower permitted maximum jacking force for the remainder of the drive, or the drive completed by some other method.

The optimum thrust speed range and slurry pressure shall be selected and kept depending on the soil properties and cover soil depth. Once the jacking operation is commenced, as far as possible, the operation should not be stopped before arriving at the reception shaft, unless otherwise agreed with the Engineer. In case that the stoppage of operation is un avoidable, proper measures for smooth restart should be taken.

Measures shall be provided to ensure that the pipeline remains stationary when any jacking rams are retracted even when face balance pressure is maintained.

Where agreed for use by the Engineer as part of the Contractor's working Programme and the method statements, a lubricant shall be injected into the annular gap between the exterior of the jacking pipe and the ground. This fluid shall be maintained until grouting is carried out.

In an emergency case during the operation, countermeasures should be taken up at first and then it should be informed to the Engineer.

The pipe jacking operation shall be carefully proceeded under the integrated control of related facilities and devices including cutting shield, slurry piping unit and slurry processing unit while monitoring each working condition. Especially the above machines or units shall be operated by the experts who have adequate experience in the use of such particular type of machine.

7.9 Injection of Lubricant and Filling Material

The Contractor shall be required to use proper liquid material as a lubricant to reduce the friction between surrounding soil and jacking pipe during thrusting concrete pipes into the soil, and after completion of jacking works between two vertical shafts, the void between surrounding soil and the external perimeter of pipes shall be filled with proper filling material.

The Contractor shall be required to select proper lubricant material taking into consideration the geologic conditions and other field conditions.

Operation Requirement is as follows;

a. Lubricant and filling material shall be injected through grout holes provided on each concrete pipe and after filling is completed, pressure of the injected material shall be maintained. After the injected material being set, the grout holes shall be completely filled with dense concrete and finished neatly without evidence of voids or projections.

b. The injection equipment should have sufficient capacity to the required injection volume and injection pressure and a pressure gauge should be installed adjacent to the injection valve.

c. Injection of filling material should be proceeded at a suitable pressure and a rate of injection to prevent any damage to the surroundings. When the void space is observed to be full of the injection material, the material injection shall be done with higher pressure in order to remove the residual groundwater or air and fill the space completely, however careful operation will be required not so as to cause over-pressure.

7.10 Sealing and Packing

Pipe joints shall comply with all relevant provisions of JSWAS-A2-1999.

Joint packing material, in accordance with the pipe manufacturer's recommendations shall be inserted at each pipe joint and at any jacking station.

After completion of jacking, annular gap behind jacked pipes shall be filled with lubricant injected under pressure, unless otherwise agreed with the Engineer.

The Contractor shall submit details of his mix design for the lubricant and provide its specification.

All lifting holes and grouting holes shall be sealed with a 1:3 cement: sand mortar with plasticizer, or a purpose-made plug and intermediate jacking areas shall be made good. After installation, all joints shall be flush to the internal walls of the pipeline and they shall be watertight.

7.11 Monitoring and Instrumentation

The Contractor shall survey, monitor and record all jacking work as it proceeds so as to form a complete record of the work which shall include records of:

a. Main survey checks (shafts and ground surface levels)
b. Alignment and level (at frequencies to be agreed with the Engineer)
c. Start and finish time of pipe advancement
d. Total length installed
e. Jacking Shield position
f. Pipe rolling
g. Thrust jack and intermediate jack loads for each pipe section including the forces needed to reinitiate jacking
h. Jacking Shield load
i. Total load
j. Settlement monitoring readings
k. Lubricant
l. General description of each discernible ground condition encountered

Copies of all records shall be supplied to the Engineer at agreed intervals and for each drive, the Contractor shall provide a record of line and level together with the corresponding jacking loads and progress graphs.

The jacking force instrumentation shall be calibrated at intervals agreed prior to the commencement of jacking by the Engineer.

The type, consumption and pressure of lubricant shall be recorded during lubrication.

All changes in conditions including, but not limited to change of jacking force, ingress of water, etc shall be recorded.

7.12 Inspection

7.12.1 Tolerances

Pipe jacking shall be carried out to the following tolerances:

a. Horizontal alignment : + / - 50 mm
b. Vertical alignment (elevation): + / - 50 mm from the given grade line of the invert.

c. Gradient: + / - 1/10

Notwithstanding the above alignment tolerances, the rate of change of direction in any plane, or combination of planes, shall not exceed the maximum value agreed by the Engineer, taking into account the pipe length, diameter, jacking loads and the pipe manufacturer's recommendations.

7.12.2 The pipeline shall be inspected regarding the tolerance, crack, damage, deformation, infiltration and so on. The Contractor shall take the necessary measure according to the instruction by the Engineer when the issues mention the above are found.

7.13 Treatment and Disposal of Construction Waste (Muck)

The Contractor shall dispose of muck in accordance with the Environmental Management Program and Indonesian laws and regulations, and Environmental Management Program.

7.14 Connection with Manholes

Jacking pipes shall be cut back such that the ends of pipes will be embedded in the wall of the manhole 50 mm beyond the inner face.

7.15 Reinforced Concrete Jacking Pipe

7.15.1 Requirement of Material

1) Reinforce concrete jacking pipes shall comply with the requirements of JSWAS-A2-1999 and shall be of the following classifications:
   (i) Standard Pipe : Type II-2000 (Mark JA51)
   (ii) Intermediate Pipe : Type II -2000 (Mark JAT51)

Table 7-1 Specification of Jacking Pipe

Item	Specification
Type	Precast Reinforced Jacking Concrete Pipe with collar
External Strength	Class II
Concrete Compressive Strength	50 N/mm^2
Dimension	
Nominal Diameter	2000mm
Inner diameter	D=2000±10
Thickness	T=175+10 /-5
Effective Length of Standard Pipe	Less than or equal to 2,500mm
Effective Length of Intermediate Pipe	Less than or equal to 1,250mm
Joint Specification	
Type	JC-0.3MPa
Water Resistance	0.3 Mpa (Water resistant under 0.4Mpa shall be tested in the factory)
Extraction Length	50 mm
Minimum Thickness	175
Material	
Cement	1) JIS R 5210 or equivalent Portland Cement 2) JIS R 5211 or equivalent Portland Blast-Furnace Slag Cement

	3) JIS R 5212 or equivalent Portland Pozzolan Cement 4) JIS R 5213 or equivalent Portland Fly-Ash Cement
Aggregate	Aggregates for Ready-Mixed Concrete of JIS A 5308 or equivalent (Ready-Mixed Concrete)
Water	Water for use with Ready-Mixed Concrete of JIS A 5308 or equivalent
Reinforcement	1) JIS G 3112 or equivalent : Steel Bars for Concrete Reinforcement 2) JIS G 3521 or equivalent : Hard Drawn Steel Wire 3) JIS G 3532 or equivalent : Iron Wires 4) JIS G 3538 or equivalent : Hard Drawn Steel Wire for Priestesses Concrete 5) JIS G 3551 or equivalent : Welded Steel Wire and Bar Fabrics
Admixture	1) JIS A 6201 or equivalent : Fly Ash for use in Concrete 2) JIS A 6202 or equivalent : Expansive Additive for Concrete 3) JIS A 6204 or equivalent : Chemical Admixtures for Concrete 4) JIS A 6205 or equivalent : Corrosion Inhibitor for Reinforcing Steel in Concrete
Steel Material	Steel materials shall conform to SS400 under JIS G 3101 or equivalent (Rolled Steels for General Structure), or SM400A under JIS G 3106 or equivalent (Rolled Steels for Welded Structure).
Gasket	Gaskets for pipe jointing shall be functionally watertight and durable. In the case of using rubber gaskets, it shall conform to JIS K 6353 or equivalent (Rubber Goods for Water Works); Class IV for Standard Pipes, and Class I - A60 for Intermediate Pipes.
Hydrogen Sulfide (H_2S) Resistance	Resistance under 10ppm of H_2S: The reinforced concrete jacking pipe which is made with the additive for H_2S resistance, or equivalent H_2S resistant jacking pipe shall be used. The inner lining pipe is not applicable considering the difficulty of quality control.

2) All proposed pipes and associated fittings, lubrication ports and couplings for incorporation in the Works shall be certified by the manufacturer that they comply with the above standard.

3) Notwithstanding such certification, any pipe found to be defective by visual examination should be rejected. Such defects shall include cracks, honeycombing or effects of incorrect handling.

4) Pipe joints shall be galvanized steel collars with rubber jointing rings recommended by the pipe manufacturer for use in sewerage pipelines.

5) Joint rings for spigot and socket pipes shall be manufactured from ethylene propylene rubber (EPM or EPDM) or styrene butadiene rubber (SBR) or natural rubber and shall comply with the requirements of BS 2494 or equivalent. They shall be suitable for use in sewerage pipelines at an ambient temperature of 300 C and shall be of size, shape that, when joined; they will provide a watertight seal.

6) Lubricant for application to rubber rings to assist jointing shall be in accordance with the manufacturer's recommendations.

7.15.2 Quality

1) Prior to the procurement of pipes the Contractor shall submit for the Engineer's approval, a quality assurance programme for pipe quality which will include testing of

pipes (including destructive testing). The cost of the quality assurance programme including the cost of testing shall be borne by the Contractor. Pipes which have not been manufactured under a quality assurance programme approved by the Engineer shall be subject to rejection.

2) The pipes shall be free of detrimental flaws, and the internal surface shall be smooth to the practical extent.

3) Concrete compressive strength of pipe shall be equal to or greater than: 50N/mm2

4) Socket used as grouting sockets for the pipes shall be as specified in JIS B 2302 (Screwed type steel pipe fittings); nominal size "2".

5) The plug used for the socket shall be as specified in JIS B 2301 (Screwed type malleable cast iron pipe fittings); nominal size "2".

6) Steel tube used for lubricant inlet shall be as specified in JIS G 3452 (Carbon steel pipes for ordinary piping); nominal size 10(A), the socket shall be as specified in JIS B 2302 (Screwed type steel pipe fittings); nominal size "3/8", and the plug shall be as specified in JIS B 2301 (Screwed type malleable cast iron pipe fittings); nominal size "3/8".

7.15.3 Manufacture

1) Materials for concrete shall be measured by weight. However, water and liquid admixtures may be measured by volume.

2) Chloride ions (Cl^-) present in fresh concrete shall not be higher than $0.30kg.m^3$.

3) Steel Collar shall be fabricated in accordance with JIS Z 3211 (Covered Electrodes for Mild Steel) or JIS Z 3312 (MAG Welding Solid Wires for Mild Steel and High Strength Steel). Welding shall be carried out by a qualified person, under JIS Z 3801 (Standard Qualification Procedure for Manual Welding Technique) or JIS Z 3841 (Standard Qualification Procedure for Semi-Automatic Welding Technique). Steel Collar shall be protected against corrosion by providing a coating in accordance with JIS K 5664 (Tar Epoxy Resin Paint), or a material having the same or a higher grade of performance. Anchors and Rubber Seal shall be provided on the embedded surface of the collar.

4) Forming of the pipes shall be carried out by setting the pre-assembled steel cage in the metallic mould, casting the mixed concrete, and compacting under spinning, roller-pressing, or by vibration methods.

5) Curing shall be conducted in a manner that will provide satisfactory results.

6) Gaskets shall be fitted securely to the specified position of the joint portion of the pipe.

7) Forming of concrete to Intermediate Pipes shall be carried out in accordance with this clause. However, for S-Type Intermediate Pipe, this shall be conducted by manual packing with concrete or mortar filling.

7.15.4 Testing Method

1) Testing for compliance with the requirements for dimensional tolerance, permeability and strength shall be in accordance with the methods and limits stated in Annex 2 of JIS A 5372.

2) External loading test shall be conducted on the pipe supported horizontally. Rubber pads (approximately 20mm thick) shall be inserted between the pipe surface and timber supports (approximately 150mm x 150mm). The bottom support may be omitted if appropriate.

3) Compressive strength test of concrete shall be carried out in accordance with JIS A 1108 (Method of Test for Compressive Strength of Concrete), using solid cylindrical test

specimens prepared in accordance with JIS A 1132 (Method of Making and Curing Concrete Specimens)

4) Water-tightness test for joint shall be carried out. The 2 pipes shall be fully jointed (no pipe-pipe gap; 0mm extraction) and the joint portion is subjected to a flood of water, either internally or externally. The water pressure is applied in accordance with the joint specification requirement and maintained for 3 minutes.

5) Pipes in a batch shall be considered as meeting the strength test requirements when all test specimens conform to the test requirements. Should any of the test specimens fail to meet the test requirement the Contractor shall be allowed a retest on two additional specimens for each specimen that failed and the pipes shall be acceptable only when all of the retest specimens meet the strength requirements.

6) The quality of materials, the process of manufacture and the finished pipe shall be subject to inspection and approval by an inspector of the Engineer. Pipes shall be subject to rejection on account of failure to conform to any of the specification requirements. Pipes may be rejected because of any of the following:

   - Fractures or cracks passing through the wall, except for single end cracks that do not exceed the depth of the joint.
   - Defects that indicate imperfect proportioning mixture and moulding.
   - Surface defects indicating honeycombed or open texture.
   - Damaged ends where such damage would prevent the making of a satisfactory joint.

7) Pipes may be repaired, if necessary, because of occasional imperfections in manufacture or accidental damage during handling and will be acceptable if, in the opinion of the Engineer, the repairs are sound and properly finished and cured and the repaired pipes conform to the requirements of the specification.

7.15.5 Marking

The pipes shall be clearly marked with the following particulars:

a. Product designation
b. Name of pipe or its abbreviation
c. Manufacturer's name or its abbreviation
d. Factory name or its abbreviation
e. Date of forming
f. Where tests have been successfully carried out on representative samples from the batch in which the unit was made

7.16 Measurement and Rates

7.16.1 Measurement

The measurement items of the work in this clause composes of the precast of reinforced jacking pipe and laying of precast reinforced jacking concrete pipe.

1) Precast of reinforced jacking pipe

Measurement is carried out with meter (m) of the installed pipeline between inside of wall from the departure shaft and arrival shaft.

2) Laying of precast reinforced jacking concrete pipe

Measurement is carried out with meter (m) of the installed pipeline between inside of wall from the departure shaft and arrival shaft.

7.16.2 Rates/Sums

1) Precast reinforce jacking pipe

The rate covers all costs for the procurement of the pipes including collar for connection to the site.

2) Laying of precast reinforcing jacking concrete pipe

The rate covers the material except the precast reinforce jacking pipes, the labor and the machine for the temporary works such as thrust wall and basement for setting the instruments of jacking method, ventilation and lighting system, excavation, jacking, injecting lubricants, monitoring, treatment and disposal of the muck and testing.

Section 8– Manhole Works

8.1 Scope of Work

8.1.1 This section covers the general requirements and specific requirements for all construction works to be carried out under the Contract. The construction works under the Contract consists but not limited to the following:

- Construction of Manhole B.

8.1.2 Manholes shall be constructed at the locations shown on the Drawings or as directed by the Engineer. Care shall be taken to ensure a complete seal of the cast-in-situ concrete of the manhole with the precast concrete. Manhole must be constructed such that they are water-tight.

8.2 Working Programme and the method statements

8.2.1 The Contractor shall prepare a Working Programme and the method statements for the works which shall be submitted to the Engineer for review and approval at least twenty eight (28) days prior to commencement of the work. Approval by the Engineer shall not relieve the Contractor of his sole responsibility for the efficiency, reliability and soundness of the method employed in completing the works in a satisfactory manner.

8.2.2 The working Programme and the method statements shall provide comprehensive descriptions of the materials, equipment, construction methods, quality control procedures, and safety measures to be used and shall be supported by materials specifications detailed shop drawings of temporary works and calculations of their structural and functional adequacy. Particular attention shall be given to demonstrate how the Contractor will manage public safety, accommodation of traffic and care of water.

8.2.3 The Contractor shall also carry out the necessary exploration, identification and collection of information about existing utility services and structures and boundary of private lot located in the vicinity of the Works.

8.2.4 The Contractor shall be responsible for obtaining relevant permits from the relevant Authorities such as work permission in the land of relevant Authorities, transplantation of road tree, use of public utilities, and agreement on the construction time. Copies of all documents shall be submitted to the Engineer.

8.2.5 The working Programme and the method statements which is stipulated in Section 11 in Division I shall adequately address the following items as a minimum requirement.

g. Personnel list in charge of the Construction works including specialist subcontractors to be used (if applicable)

h. Specification of material

i. Details of the surface establishment including offices and accommodation; equipment layout;

j. Programmed daily working hours and duration of the operation

k. Health and safety arrangements including a strategy for dealing with noise pollution problems; manual handling; vibration; heat; dust and chemicals; contaminated water and soils; flooding; methane and other atmospheric contaminants; fire and smoke; access and rescue; oxygen deficiency; and working space.

8.3 Construction of Manholes

8.3.1 Reinforced concrete manhole block and cast-in-place concrete manhole shall be provided at the locations indicated on the drawings, or as directed by the Engineer.

8.3.2 Concrete for Slab, Staircase, Mortar Finishing and Invert Concrete

Concrete work including formwork shall be carried out as indicated on the Drawings.

8.3.3 Deformed Reinforcing Bars

Deformed reinforcing bars shall be carried out as indicated on the Drawings.

8.3.4 Steel Angle Seating to Manholes

a. Steel angle edging shall be provided to provide a precise and level uniform bearing for the manhole covers.

b. Edging shall be structural mild steel angle in accordance with JIS G 3101, SS 400 or ASTM A 36. Angle shall be hot dip zinc galvanised after fabrication to BS 729 (EN ISO 1460)

c. Mild steel flat bar lugs shall be welded on to the angle at not more than 500 mm centres and also tack welded to the reinforcement for secure fixing.

8.3.5 Manhole Cover

Concrete cover shall be provided as indicated on the Drawings.

8.3.6 Lifting Rings

a. Mild steel Hinged Lifting rings shall be provided to all covers

b. Rings and hinges shall be hot dip galvanised after fabrication to BS 729 (EN ISO 1460)

8.5.7 Ladder Rungs, Rear Guard, Frame of Concrete Cover and Stainless Balustrade Manhole step irons

Step irons for manholes shall be provided as indicated on the Drawings. The material shall follow JIS G 4321., from plain round bars, galvanised.

8.5.8 Backfilling

On completion of the shafts installation, backfilling shall be undertaken in compacted layers with materials approved by the Engineer, to the grade and elevation as designated in the Drawings. Equipment shall be approved by the Engineer.

8.5.9 Clearing and Restoration of Site

After the backfill is completed, the Contractor shall dispose of all surplus material, dirt, and rubbish in the disposal area designated in the Drawings or as directed by the Engineer. The Contractor shall restore all disturbed areas to their original condition.

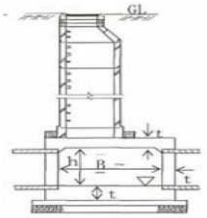
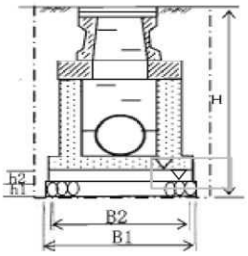
8.5.9 After the completion of manhole work of manhole A and C, the concrete cover shall be constructed as indicated in the Drawings for security reason.

8.6 Tolerances

8.6.1 Manhole works shall be carried out to the following tolerances:

Table 8-1 Tolerances of Manhole Works

Category	Item	Tolerance	Diagram

Manhole	Elevation of base ▽	± 30 mm	
	Width (B)	— 30 mm	
	Height (h)	± 30 mm	
	Wall thickness (t)	— 20 mm	
	Elevation of top	±30 mm	
Manhole Basement	Elevation of top ▽	± 30 mm	
	Depth (H)	± 30 mm	
	Concrete slab width (B2)	— 30 mm	
	Concrete slab thickness (h2)	— 10 mm	

8.6.2 the tolerance indicated in Table 8-1 will be measured at all manholes constructed in the project

8.7 Material

8.7.1 Concrete

Concrete shall be in accordance with the requirements in Drawings.

8.7.2 Reinforcement

Reinforcement shall be deformed bars of the sizes shown on the Drawings and follow the requirements specified in Section 9 – Concrete Work.

8.7.3 Manhole Covers

Manhole covers shall be in accordance with the requirements in Drawings.

8.8 Measurement and Rates

8.8.1 Measurement

1) Slab, Staircase and Invert Concrete (concrete work)

The measurement is carried out with cubic meter (m^3) of the concrete based on the as-build drawings.

2) Mortar Finishing (concrete works)

The measurement is carried out with square meter (m^2) of the concrete based on the as-build drawings.

3) Deformed Reinforcing Bars

The measurement is carried out with tons (t) of the deformed reinforcing bars based on the as-build drawings. The weight of the material for placing and fixing to proper space shall be excluded from the measured amount.

4) Installation of Reinforced Concrete Manhole Block, Cast-in-place Concrete Manhole and Manhole Cover (RC cover ϕ 600mm)

The measurement is carried out with set as mentioned in the Bill of Quantities.

5) Manhole Cover (Concrete Cover)

The measurement is carried out with number of the concrete cover supplied and installed as indicated in the Drawings.

6) Ladder Rungs

The measurement is carried out with number of the Ladder Rungs supplied, fabricated and installed as indicated in the Drawings.

7) Rear Guard

The measurement is carried out with set of the Rear Guard supplied, fabricated and installed as indicated in the Drawings.

8) Stainless-Steel Balustrade is carried out with meter (m) of the Stainless Steel Balustrade supplied, fabricated and installed as indicated in the Drawings.

8.8.2 Rates

1) Slab, Staircase and Invert Concrete (concrete work)

The rate cover the labor, the material and the machine for mix design, trial mix, formwork, temporary works such as supporting and scaffolding, curing and testing concrete.

2) Mortar Finishing (concrete works)

The rate cover the labor, the material and the machine for mix design, trial mix, formwork, temporary works such as supporting and scaffolding, curing and testing concrete.

3) Deformed Reinforcing Bars

The rate covers the labor, the material and the machine for forming, placing and fixing the deformed reinforcing bars.

4) Installation of Reinforced Concrete Manhole Block, Cast-in-place Concrete Manhole and Manhole Cover (RC cover ϕ 600mm)

The rate covers the labor, the material and the machine for supplying, installing and placement of concrete, formwork and reinforcement as indicated in the Drawings.

5) Manhole Cover (Concrete Cover)

The rate covers the labor, the material and the machine for supplying, installing and placement of concrete, formwork and reinforcement as indicated in the Drawings.

6) Ladder Rungs

The rate covers the labor, the material and the machine for supplying, installing and placement of the Ladder Rungs as indicated in the Drawings.

7) Rear Guard

The rate covers the labor, the material and the machine for supplying, installing and placement of the Rear Guard as indicated in the Drawings.

8) Stainless-Steel Balustrade

The rate covers the labor, the material and the machine for supplying, installing and placement of the Stainless-Steel Balustrade including concrete, formwork and reinforcement as indicated in the Drawings.

Section 9 - Concrete

9.1 Scope of Specification

9.1.1 This Section provides a common reference for the requirements and procedures for Concrete, generally including, materials, mixing, transporting and placing, vibrating, curing and finishing works.

9.2 Materials

9.2.1 General

1) The Contractor shall select material sources to ensure a uniform colour and surface finish on all exposed surfaces.
2) Materials shall be delivered, handled and stored in such a manner as to preserve their quality and condition to the standards required by the Contract. The quantity of materials and components stored on the Site shall be consistent with that necessary for efficient working and located so as to facilitate their prompt inspection.
3) Unless otherwise described in the Contract, the handling, use, installation, application or fixing of materials and components shall be in accordance with all applicable recommendations of the manufacturers. Where appropriate, the Contractor shall make use of any technical advisory services offered by the manufacturer.
4) Materials that do not comply with the requirements of this Specification will be rejected by the Engineer and removed immediately from the Site of the Works unless otherwise instructed by the Engineer. No rejected materials shall be used in the Works.
5) As soon as possible after the Contract has been awarded, the Contractor shall submit to the Engineer for his approval a list of his proposed suppliers and sources of materials required for the execution of the Works.
6) Samples shall be taken in accordance with the appropriate International Standard, or as directed by the Engineer.
7) The materials subsequently supplied shall conform to the quality of samples, which have been approved by the Engineer.
8) Names of additional suppliers and sources may be submitted by the Contractor during the execution of the Contract, but no source of supply shall be changed without the Engineer's approval.

9.2.2 Cement

1) The cement shall be factory produced standard colour Type I complying in all respects with ASTM C150 (AASHTO M85) or similar approved.
2) One brand of cement as approved by the Engineer shall be used for all concrete works throughout the project unless otherwise authorized.
3) The Contractor shall provide manufacturer's test certificates and proof that the specifications have been complied with, together with a note of the date of manufacture, certified by an independent agency in the country of origin. The Engineer shall have the power to reject a part or the whole of any consignment of cement if he considers it to be unsuitable for use in the Works.

9.2.3 Aggregates - Generally.

1) All aggregates shall comply with the relevant provisions of ASTM C33/C33Mand

consist of tough, hard, durable and uncoated particles. The Contractor shall be responsible for satisfactorily processing this material to meet the requirements of the Specifications. Thirty days before starting work, the Contractor shall advise the Engineer of the sources of aggregates to be used to permit samples to be taken in the presence of a representative of the Engineer and the Contractor to test before being brought to the Site. Approval of aggregate quality and/or gradation shall not waive the responsibility of the Contractor to produce concrete of the strength specified.

2) Fine and coarse aggregates shall be tested in accordance with the following standards:

Table 9– 1 Fine and Coarse Aggregates Test

ASTM	Testing Requirement
C 40	Organic Impurities
C 88	Soundness
C 136	Sieve Analysis
C127/ 128	Density. Relative Density and Absorption
C131/ 535	LA Abrasion Test

3) The Contractor shall use only fine and coarse aggregates in concrete that are non-reactive with the alkalis in the cement in an amount sufficient to cause excessive expansion of the concrete. Acceptable aggregate shall be based on satisfactory evidence furnished by the Contractor that the aggregate is free from such materials. This evidence shall include service records of concrete of comparable properties under similar conditions of exposure and/or certified records of tests by a testing laboratory. Testing for this shall be in accordance with ASTM C 227, ASTM C 295 and ASTM C 289.

4) When requested by the Engineer, the supplier shall provide any of the following information for the purpose of initial assessment of the suitability of an aggregate, and approval prior to delivery to the Site of the Works. The result information shall be determined in accordance with the relevant Standard.

   a. Source of supply: Name and location of the quarry or pit

      Aggregate type

   b. Typical Properties: shape, surface texture, flakiness index, 10% fines, aggregate impact value, particle density, water absorption values, grading, fines, shell content, acid soluble sulphate content, chloride ion content and drying shrinkage.

5) Approval of aggregates will not prevent later rejection if results of subsequent tests do not reflect compliance with the requirements of the specified standards.

9.2.4 Fine Aggregate

1) Fine aggregate shall consist of natural sand or other inert materials with similar characteristics, having hard, strong, durable particles. Fine aggregate shall be clean and free from extraneous materials, clay balls, organic matter or other detrimental material in accordance with AASHTO M6. The maximum combined quantity of soluble chlorides and sulphates in the fine aggregate shall not exceed 1000 ppm fine aggregate.

2) The fine aggregates shall be reasonably graded and shall meet the grading requirements contained in Table9- 2:

Table 9 - 2: Fine Aggregates

Sieve Size	Percentage by mass passing sieve
mm	Overall limits

9.5	100
4.75	95 to 100
2.36	80 to 100
1.18	50 to 85
0.600	25 to 60
0.300	5 to 30
0.150	2 to 10

3) If required by the Engineer and in order to meet specification requirements, fine aggregates for use in reinforced concrete shall be washed with fresh potable water.

9.2.5 Coarse Aggregate

1) Coarse aggregate for concrete shall comply with all relevant provisions of AASHTO M 80 and ASTMC 33, including quality and grading requirements and be homogeneous, clean, free from extraneous materials, clay lumps, organic matter, and alkaline and detrimental material. The Engineer may order that the coarse aggregate be washed if it is unclean.

2) Aggregates containing opal shall not be used.

3) Aggregate containing iron pyrites shall only be used with the approval of the Engineer.

4) Marine aggregates shall not be used for structures in contact with raw or treated water unless specifically agreed with the Engineer.

5) Coarse aggregates shall be reasonably graded and shall meet the grading requirements in Table 9 - 3:

Table 9 - 3: Coarse Aggregates

Sieve Size (mm)	**Percentage Passing by Mass**	
	Concrete Class A, B and C	**Concrete Class E**
37.5		100
25	100	95 - 100
19	90 – 100	
12.5	30 – 70	25 - 60
No. 4	0 – 10	0 – 10

9.2.6 Sands fr Mortar

1) Sands for mortar and grout shall comply with AASHTO M45 or BS 1200 and be graded in accordance with Table 1 of that Standard.

2) Sands for floor screeds shall comply with the relevant provisions of BS 882.

3) Sands for external renderings and internal plastering with lime and shall comply with the relevant provisions of BS 1199.

4) All sands are required to comply with BS 882, BS 1199, or BS 1200 for washed sands.

9.2.7 Lime for Mortar

1) Lime for mortar shall be in the form of lime putty, complying with the relevant provisions of ASTM C 207 (Type N) or BS 890.

9.2.8 Cement Grouts

2) Cement grout shall be mixed in the relevant proportions indicated in the following Table

9 – 4 using the minimum quantity of water to ensure the necessary fluidity and to render it capable of penetrating the work.

3) Cement grout shall be used within one hour of mixing, except where containing a retardant admixture.

Table 9-4 Nominal mix by mass

Cement	Sand
1	-
1	3
1	10

9.2.9 Mortar

1) Mortar shall be mixed only as and when required in the relevant proportions indicated in Table 9 - 5, until its colour and consistency are uniform. The constituent materials shall be accurately gauged, allowance being made for bulking of sand.

2) All mortar shall be conveyed fresh to the Works as required for use. Mortar which has begun to set or which has been Site-mixed for a period of more than one hour shall not be used.

Table 9-5: Mortar

Plastering Cement: sand
1:2
1:3

9.2.10 Water for Mixing and Curing

1) Unless otherwise agreed in writing by the Engineer, water for use with cement, curing or in contact with potable water installations shall be of potable water quality and free from oil, salt, acid, sugar, vegetable or any deleterious substance.

2) The Engineer may require additional compliance testing at any time, of any water source.

9.2.11 Admixtures

1) Admixtures shall not be used without the written approval of the Engineer. The Contractor shall provide detailed product information of any additive he may wish to use and shall be entirely responsible for the use of any approved admixture in strict accordance with the manufacturer's instructions.

2) Accelerating, retarding and water-reducing admixtures for concrete or grout shall comply with the relevant provisions in BS 5075 Part 1 or AASHTO M 194.

3) Air-entraining admixtures shall comply with the relevant provisions of BS 5075 Part 2 or AASHTO M 157. Super plasticising admixtures shall comply with the relevant provisions of BS 5075 Part 3 or ASTM C1017.

4) Calcium chloride or chloride-based admixtures will not be permitted.

5) To avoid cold joints the Contractor shall ensure sufficient concrete capacity either on site or at the producing plant and concrete transporting arrangements and use an appropriate retarder when deemed necessary by the Engineer.

6) Retarders shall not be used together with other admixtures in the same concrete mix unless data is provided to assess their interaction and to ensure their compatibility and as approved by the Engineer. The fluid content of admixtures shall be considered in the

determination of water/cement ratios.

7) Preliminary tests of cylinder strength and any other tests shall be carried out for all concrete with admixtures. When the Engineer approves changing the brand or type of cement, the Contractor will be required to carry out further tests and establish a relative mix design.

9.3 Storage of Materials

9.3.1 Cement

1) Cement shall be delivered to the Site in sealed bags or water-tight barrels bearing the manufacturer's name, cement type and the date of manufacture. The bagged cement shall be stored in piles not more than eight bags high. Storage areas shall be dry waterproof sheds or other such temporary buildings, exclusively for cement and erected with the floors raised well above the ground in areas agreed with the Engineer. The storage capacity shall correspond to the amount of concrete required for the largest units to be cast. On completion of the Works the storage shall be dismantled and removed, and the site restored to its original condition by the Contractor.

2) A passage of at least one metre shall be left between the cement and the side walls of the storage sheds. Access ways shall also be left between containers so that every one is visible. Each consignment of cement shall be stored separately and consignments shall be used in the order in which they are delivered. Any cement showing signs of initial setting or otherwise adversely affected shall be rejected and removed from the Site completely at the Contractor's own expense.

3) Access shall be available to the Engineer at all times.

4) Cement delivered by bulk carriers shall be stored in purpose made silos. All operations for handling of bulk cement shall be by approved methods that prevent contamination of the cement. The cement storage silos shall be provided with interior moisture control devices that keep the cement dry and prevent premature hydration in the silos. The silos shall be provided with access ladders and entry ways so that samples can be extracted from various levels of each silo for testing purposes.

9.3.2 Aggregates

1) Aggregates shall be stored in such a way as to prevent segregation and contamination. Aggregates from different sources or of different grading shall be stored in separate compartments, each having a concrete or similar hard bed, laid to a fall to drain off surface water.

2) Aggregates shall be protected from moisture during periods of prolonged severe weather.

3) Aggregate which has become segregated or contaminated with foreign matter during storage or handling will be rejected and shall be removed and reprocessed and/or replaced with material of acceptable quality. Aggregates shall be stored in sufficient quantity to ensure that there is no interruption of concreting work at any time.

9.4 Concrete – Classes

10.4.1 The class of concrete to be used in each part of the Works shall be as indicated on the Drawings or as directed by the Engineer.

9.4.2 The approximate weights or volumes of the components for each class of concrete and any other data given in any table of this Specification are an aid to for suggested trial mixes and may be of value to Contractors in determining the approximate quantities of components

required. However, the minimum crushing strength at 7 days and 28 days must be strictly adhered to. Acceptance of the work by the Engineer will be based on 28-day strength as determined in accordance with requirements and procedures noted under this Specification Section.

9.4.3 Structural Concrete Class

Concrete for Use in Structures shall be in accordance with Tables 9 – 6 with the properties and strength requirements as follows:

Table 9 - 6: Properties and Strength Requirement of Concrete

Class of Concrete	28-day Compressive Strength (N/mm^2)	Max. Size of Aggregate (mm)	Application
A-3 K350	**35**	**25**	**Pouring Concrete under water required for the press-in method**
B K250	**25**	**25**	**Reinforced Concrete**
D K175	**17.5**	**40**	**Invert Concrete**
E K125	**12.5**	**25**	**Leveling Concrete**

9.4.5 Measurement

Aggregates and cement shall be measured by mass except that the aggregates for C10 and C15 may be measured by volume where the Engineer is satisfied that this is the only available means.

9.4.6 Adjustment to minimum cement content

Where the Contractor submits any proposal for the approval of the Engineer to use aggregates of nominal size greater than 20 mm, the minimum cementitious content in Tables 9 - 6 shall be modified as follows:

Table 9- 7

Nominal maximum aggregate size (mm)	Adjustments to minimum cementitious content in kg / m^3
10	+40
14	+20
40	-30

9.5 Concrete Mixes

9.5.1 Mix Design

1) Where the Contractor proposes alternatives to a Designed mix these shall be in accordance with Sections 3, 4 or 5 of BS 5328: Part 2, Prescribed , Standard and Designated mixes The information specified under Clause 3.1 of BS 5328: part 3 shall be given to the Engineer in every case, not less than 7 days before the start of concrete production. Further information specified in Clauses 3.2 and 3.3 of BS 5328: Part 3 shall also be given to the Engineer as required.

2) Before designed mix concrete is supplied, the Contractor shall, not less than 7 days before the start of concrete production, provide all pertinent information specified in Clauses 3.1 to 3.5 inclusive of BS 5328: Part 3.

3) Samples of all materials to be used in the mixes shall be submitted to the Engineer for testing and such samples shall be tested in the site laboratories or as directed by the Engineer. No materials forming any part of this mix shall be delivered to the Site before the Contractor receives the prior written approval of the Engineer for such material.

9.5.2 Trial Mix

1) After receiving written approval by the Engineer of the samples, the Contractor shall arrange for trial mixes.

2) Trial mixes are required for all grades and mixes of concrete proposed in the permanent Works. For each trial mix, three separate batches of concrete shall be made using materials typical of the proposed source of supply and, where practicable under full scale production conditions. The suitability of the proposed mix proportions of shall be determined in accordance with BS 5328.

3) The suitability of the proposed mix proportions of Designed mixes to meet the specified maximum free water/ cementitious ratio shall be determined in accordance with BS 5328: Part 3, Clause 3.5.

4) The workability of each of the trial batches shall be determined and three cubes made from each batch for test at 28 days.

5) Additional sets of cubes/cylinders from each batch may be required for test at an earlier age as requested by the Engineer.

6) The Contractor shall test preliminary cubes/cylinders as the Specification and BS 1881.

7) Where full-scale trial mixes are not practicable and the total concrete quantity is less than 150 m3, the Contractor may request the Engineer to approve the use of laboratory scale mixes.

8) The Contractor shall not start producing structural concrete on site until the trial mixes required by the Engineer have been proved.

9) Where the Contractor intends to purchase factory-made precast concrete units, the Engineer may dispense with trial mixes and laboratory tests, provided that the evidence is given to confirm that the factory produces durable concrete that complies with the Contract. This evidence shall include details of mix proportions, water / cement ratio, workability and strengths obtained at 7 and 28 days.

9.5.3 Mix Design

1) After receiving written approval by the Engineer of the samples and the results of the trial mixes, the Contractor shall submit in writing to the Engineer his proposed mix designs to be used for each specified class of concrete for the project.

2) No concrete works will be allowed to commence before the Contractor receives in writing from the Engineer approval of the Contractor's proposed mix design.

3) The Contractor must make arrangements for all the foregoing as early as possible and to allow the Engineer sufficient time to review the designs(s) and if necessary conduct and/or require additional strength testing.

4) In the event of any changes in characteristics or source of supply of any of the component parts, a new mix design must be submitted for approval by the Engineer as described. Any delay due to such changes will be entirely the responsibility of the Contractor and no claims for delay or compensation will be considered. During the

progress of the Contract the Engineer can direct samples be taken of the work mix at any time, in order to check their compliance with the approved mix design.

5) In addition to the requirements in Clauses 2.1 and 5.1, at least 7 days before any concrete works are proposed the Contractor shall submit to the Engineer the following information to obtain approval before concreting commences:

   a. The nature and source of each constituent material.

   b. The source of supply of concrete and any alternative source.

   c. Details of each concrete mix with the proposed proportions or quantity of each constituent per cubic metre of fully compacted concrete, and evidence of suitability of the mix to meet the specified requirements.

   d. Details of admixtures to be used.

   e. Details of the proposed general method of construction, striking times of formwork, and the methods of placing concrete with particular regard to the construction of Formwork and Joints.

   f. The proposed methods of curing concrete.

   g. Such details, shall not be changed without written notice to the Engineer and his subsequent approval to any proposed alternative.

9.5.4 Adjustments to Mix During Progress of Work

After a mix design has been approved, as prescribed above, these proportions of the constituents of the mix design shall not be changed during the progress of the work except with the Engineers agreement as follows:

a. Adjustments for variations in workability:

   If it is found impossible to obtain concrete of the desired workability with the proportions originally determined, the Engineer may allow changes in aggregate weights as he may deem appropriate.

b. Adjustment for minimum strength:

   If it is found impossible to produce concrete having the minimum allowable strength specified, the cement content shall be increased as directed by the Engineer.

c. Adjustment for new materials:

   No change in the source or character of the materials shall be made without due notice to the Engineer.

   No new materials shall be used until the Engineer has accepted such materials and new proportions based on the tests of trial mixes have been determined.

9.6 Chemical Content

9.6.1 Chloride Content

1) Calcium chloride or admixtures containing calcium chloride shall not be used in the production of reinforced concrete or concrete containing embedded metal.

2) Steam-cured concrete shall not contain ions, derived from all of its constituents, in excess of 0.1% by mass of its cementitious content. The percentage for all other concrete containing embedded metal in the final work shall not exceed the following:

   a. Concrete: 0.4, except that the proportion may be up to 0.5 in not more than 5% of

the test results.

b. Concrete made with Sulphate Resisting cement: 0.2

3) Assessment of compliance shall be in accordance with Clause 3.7 of BS 5328: Part 4 and shall be where practicable, the total chloride content should be calculated from the mix proportions and the measured chloride contents of each of the constituents.

9.6.2 Sulphates

The amount of sulphate in the concrete shall not exceed 800 ppm when calculated on the total concrete mass, or 5,000 ppm when calculated on the amount of the cement in the actual mix. For the above-mentioned calculations, the amounts of sulphate shall be determined by laboratory analyses of the cement, aggregates, water and admixtures. The analyses shall be carried out by recognized methods.

9.6.3 Alkali silica Reaction

Where the Contractor proposes to use aggregates containing silica that may be susceptible to attack by alkalis precautions shall be taken as described in BS 5328 Part 1 1990 Clause 5.2.4

9.7 Water Cement Ratio

9.7.1 The quantity of water used in mixing shall comply with the requirements for the maximum water / cementitious ratio, and be approved by the Engineer on the basis of preliminary tests and trial mixes. It shall be the least amount that will produce a workable homogeneous plastic mixture which can be worked into the forms and around the Reinforcing Steel Bar. In no circumstances shall the consistency of the concrete be such as to permit a separation of the aggregate from the mortar during handling. Excess water shall not be permitted and any batch containing such excess will be rejected.

9.7.2 In measuring water for each batch of concrete, allowance shall be made for the water contained in the aggregates. The total water in the batch shall be deemed to consist of the water carried by the aggregates plus the water added.

9.7.3 Frequent tests including the slump test shall be carried out to ensure that a consistent water content is maintained.

9.8 Testing, Compliance and Records

9.8.1 Testing

1) The Contractor shall allow for carrying out preliminary and works concrete tests in accordance with the appropriate Standard as follows:

   a. AASHTO T22 and T23 (ASTM C31 and C39), Method for Testing the compressive strength of cylindrical concrete specimens.

   b. BS 1881, Method of testing Concrete

2) All concrete work will be subject to sampling and testing as directed.

3) A minimum of one sample shall be taken from each grade of concrete on each day that concrete is placed. This rate may be increased at the request of the Engineer for critical elements or at the start of construction or when conditions change to establish the level of quality.

4) The test specimen shall have the compressive strength specified for each particular quality and grade of concrete at the appropriate age. If the required strength has not been attained at 28 days the Contractor shall cut out and reconstruct all work represented by the test specimen.

5) For BS Prescribed Mixes, when instructed to do so by the Engineer the Contractor shall take specimens from a randomly selected batch of concrete and arrange for strength testing of 150 mm test cubes at 28 days as specified in BS 1881. The results will normally be for the Engineers own use in assessing the performance of a prescribed mix.

6) For Specified Mix Proportions the weight of dry aggregate to each 100kg of cement shall not exceed 105% of that specified. The Engineer may require that analysis tests on fresh concrete be carried out in which case the mix shall be deemed to comply if the weight of dry aggregate to each 100kg of cement is not more than 110% of that specified.

9.8.2 Compliance

For the assessment of compliance with the specified characteristic strength of Designed Mixes in structures a sample shall, unless otherwise described in the Contract or directed by the Engineer, be taken from a randomly selected batch of concrete at the minimum rate of sampling recommended in Table 9 - 8. Three test specimens shall be prepared from the sample as directed, which shall be cured for 28 days and tested. The average of the results shall be taken as the test result. If the difference between the results divided by their mean exceeds 15% the test result shall be deemed invalid.

Table 9 - 8 Batch of Concrete at Minimum Rate Sampling

Type of Structure	Average rate of sampling: one sample per
Critical Structures, e.g.: cantilevers, columns, suspended slabs	All pours up to 10 m^3
Intermediate Structures, e.g.: beams, ground slabs, bridges, decks and walls	20 m^3
Heavy concrete construction, e.g.: foundations, solid rafts	50 m^3

9.8.3 Strength Requirements

All concrete used in the work shall meet the compressive strength and slump requirements specified in Table 9-9, or approved by the Engineer, when sampled, cured and tested in accordance with SNI 03-1974-1990 (AASHTO T22), SNI 03-4810-1998 (AASHTO T23), SNI 03-2493-1991 (AASHTO T126), SNI -2458-1991 (AASHTO T141).

Table 9 - 9: Mix Property Requirements

Concrete Class	Minimum Compressive Strength (kg/cm²)						"SLUMP" (mm)	
	15 cm x 15 cm x 15 cm Cube Specimens			15 cm x 30 cm Cylinder Specimens			Vibrated	Non Vibrated
	3 day	7 day	28 day	3 day	7 day	28 day		
K600	260	390	600	215	325	500	20 - 50	-
K500	215	325	500	170	260	400	20 - 50	-
K400	170	285	400	140	240	330	20 - 50	-
K350	150	250	350	125	210	290	20 - 50	50 - 100
K300	130	215	300	110	180	250	20 - 50	50 - 100
K250	110	180	250	90	150	210	20 - 50	50 - 100
K225	97	150	225	81	125	190	20 - 50	50 - 100
K175	75	115	175	62	95	145	30 - 60	50 - 100
K125	55	80	125	45	70	105	20 - 50	50 - 100

Note :

When a concrete pump is used, the slump may be in range of 75 ± 25 mm.

9.8.4 Records / Test Results

1) The Contractor shall, for each cylinder/cube taken, keep and make available to the Engineer detailed records showing:-
   a. Cylinder/Cube reference number
   b. Location and batch from which the sample has been taken for the preparation of the cube/cylinder.
   c. Date of preparation
   d. Weather
   e. Date of testing
   f. Age and strength of concrete
2) Where test results are below the minimum acceptable the Contractor may be given the opportunity to demonstrate that the concrete in the structure has adequate strength. Such demonstration shall be by one of the following methods, as appropriate and agreed by the Engineer.
   a. Subjecting the parts of the structure concerned to a loading test, under supervision and to the approval of the Engineer.
   b. Cutting core samples for compression testing.
3) All tests must be carried out in a manner as acceptable to the Engineer and shall be conducted by the Contractors Independent Laboratory. The Contractor shall bear all expenses involved in obtaining, cutting-out or sampling all specimens and/or component parts for testing.
4) If the Contractor elects to remove and replace the defective concrete without waiting for the results of the 28-day test, concreting can then continue entirely at his responsibility.

9.8.5 Slump Tests

1) The Contractor shall when required by the Engineer, carry out slump or compacting factor tests in accordance with ASTM C 143 or BS1881 Parts 102 and 103.
2) The measured slump shall be 75 mm as indicated in Table 1 of BS 1881 Part 102, unless otherwise indicated or if the Contractor has submitted for approval from the Engineer of an alternative for a designed mix concrete.
3) One slump test, or more as directed by the Engineer, shall be carried out on every batch

of concrete produced, and the test shall not be deemed valid unless witnessed by the Engineer or his representative.

4) Mixes of the stiffest consistency that can be placed efficiently shall be used. Over wet mixes will be rejected.

9.8.6 Maturity Testing

1) Maturity testing to determine the compressive strength of in-situ concrete may be used for the following situations:

   a. To allow early stripping of forms.

   b. Prior to the application of post tensioning force.

   c. Prior to launching of a traveller.

2) The Contractor shall nominate details of his proposed procedure for the use of maturity testing for determination of early concrete strength. This procedure shall address the use of conventional test cylinder results to substantiate maturity testing predictions and the proposed locations of thermocouples within the concrete pour.

9.9 Concrete Mixing / Transporting / Placing / Compacting

9.9.1 General

1) The Contractor shall not give less than 24 hours notice in writing to the Engineer of his intention to commence concreting.

2) The Contractor shall not pour concrete until the Engineer has inspected and approved the formwork and Reinforcing Steel Bar. The method and sequence of placing concrete shall be as approved by the Engineer.

3) A period of 6 hours for inspection shall be allowed after the work is clean and ready for concreting. If the work is not approved, the Contractor shall give notice in writing again and allow a further 6 hours for inspection after the necessary correction or modification has been carried out.

4) If concreting is not started within 24 hours of approval being given, consent shall be obtained again.

5) Delivery of concrete shall be regulated that placing is at a continuous rate unless delayed by the placing operations. If the delivery between batches exceeds 30 minutes, or concreting stops for any other reason, the Contractor shall terminate the placing of the concrete and form stop ends or construction joints in a manner approved by the Engineer.

6) The Engineer shall decide whether to abandon the pour and have the concrete removed.

7) The Engineer may require that all structural concrete mixing, placement and curing be accomplished in shaded areas.

9.9.2 Ready-mix Concrete

1) Where concrete is to be obtained from a ready-mix supplier, the Contractor shall obtain the Engineer's approval of the source.

2) The Contractor shall also inform the Engineer of an alternative supplier, available to him if the approved source has to be withdrawn by the Engineer.

3) The delivery ticket required for each load of ready-mixed concrete shall detail as a minimum:

   a. The type and nominal maximum size of aggregate

b. The type or name and proportion of any admixture

c. The actual cementitious content

d. The position of the concrete in the Works

4) All delivery tickets shall be retained on site and shall be made available for inspection by the Engineer.

5) The concrete shall be carried in purpose made agitators, operating continuously, or truck mixers.

6) The concrete shall be compacted and in its final position within 2 hours of the introduction of cement to the aggregates. The time of introduction shall be recorded on the delivery note.

7) When truck-mixed concrete is used, water shall be added under supervision either at the site or the central batching plant as directed but in no circumstances shall water be added in transit.

8) Truck mixer units and their mixing and discharge performance shall comply with the requirements of the appropriate Standard, BS 5328 or ASTM C94. Mixing shall continue for the recommended number and rate of revolutions, or in the absence of the manufacturer's instructions, mixing shall continue for not less than 10 revolutions at a rate of not less than 7 revs / min.

9) The use of any additive to the concrete or the materials is forbidden unless written approval is given by the Engineer.

9.9.3 On-Site Batching

1) The location of on-site batching and mixing plants shall be agreed with the Engineer and the Contractor must submit to the Engineer for approval, before erection of any mixing plant, his proposed arrangements for the storing of aggregates and the batching and mixing of the concrete. He must also submit details of the types of mixers to be used, including nominal capacity and rated drum speed, and his proposals for conveying the mixed concrete from the mixer to the points of deposit.

2) All concrete shall be mixed and batched by weight of materials at the batching plant unless otherwise directed by the Engineer. The weight-batching machines used shall be of a type approved by the Engineer and shall be kept accurate and in good condition while in use on the Works. Checks may be made as required by the Engineer.

3) The batching plant shall include separate bins for the bulk cements, fine aggregate and for each size of coarse aggregate, a weighing hopper, and scales capable of determining accurately the weight of each component of the batch.

4) Scales shall be accurate to one percent throughout the range of use.

5) Either sacked or bulk cement may be used. No fraction of a sack of cement shall be used in a batch of concrete unless the cement is weighed.

6) When cement is placed in contact with the moist aggregates, batches will be rejected unless mixed within 1.5 hours of such contact.

7) All bulk cement shall be weighed on an approved weighing device. The bulk cement weighing hopper shall be properly sealed and vented to preclude dusting during operation. The discharge chute shall not be suspended from the weighing hopper and shall be so arranged that cement will not lodge in it nor leak from it.

8) Accuracy of batching shall be + 1 percent of the required weight.

9) Water may be measured either by volume or by weight. The accuracy of measuring the

water shall be within + one percent of the required weight or volume. The measuring device shall be such that its accuracy is not affected by variations in the water supply pressure.

10) Arrangements for the cooling of the mixing water shall be as approved by the Engineer.

11) All aggregates produced or handled by hydraulic methods and washed aggregates shall be stockpiled or binned for draining at least 12 hours before being batched. In case the aggregates contain high or non-uniform moisture content, a storage or stockpile period in excess of 12 hours may be required by the Engineer.

12) The accuracy of measuring the aggregates shall be within + two percent.

13) The approved type of mixer shall have a drum rotating about a horizontal or inclined axis and must be kept in good condition at all times. The drum shall rotate at the appropriate speed indicated on the manufacturer nameplate, and as approved by the Engineer. Continuous mixers will not be permitted.

14) About 10 percent of the water required for the batch shall enter the drum in advance of the cement and aggregates, and the remainder of the water shall be added uniformly while the drum is in action so that all the water is in the drum by the end of the first quarter of the mixing time. The concrete shall be mixed until a mixture of uniform colour and consistency is obtained.

15) The optimum mixing time, shall be measured from the time all materials, except water, are in the drum and shall be confirmed by Site trials. For a mixer with a capacity of 750 litres or less, mixing shall continue for at least 1.5 minutes after all the water has been added. For each additional 500-litre capacity or fraction thereof, the minimum mixing time shall be increased by 15 seconds. Where double-drum high performance mixers of a type approved by the Engineer are used, a minimum mixing time of 70 seconds may be allowed. The mixer shall be equipped with an approved timing device to control discharge.

16) The volume of concrete mixed per batch shall not exceed the mixer's nominal capacity as shown on the manufacturer's standard rating plate on the mixer. The whole of the batch shall be removed before materials for a fresh batch enter the drum. On cessation of work, including all stoppages exceeding 20 minutes, the mixers and all handling plant shall be washed with clean water. Any deposits of old concrete in the drum shall be cleaned out by rotating clean aggregate and water in the drum before any fresh concrete is mixed.

17) Concrete mixed as specified above shall not be modified by the addition of water or in any other manner to facilitate handling or for any other reason.

9.9.4 Transport, Placing and Compacting

1) Concrete transportation, immediately after mixing shall be in accordance with BS 5328 or ASTM C94, and arranged to prevent the segregation, loss or contamination of material, and maintain workability. The time from mixing to placement in the Works shall not exceed one hour. The concrete shall be deposited as near as practicable to its final position and all equipment for transporting concrete shall be kept clean.

2) Concrete shall be thoroughly compacted in its final position within 30 minutes of discharge from the mixer, unless carried in purpose made agitators operating continuously, when the time shall be within 2 hours of the introduction of the cement to the mix and within 30 minutes of the discharge from the agitator.

3) The Contractor shall always be responsible for the concrete being placed and compacted within such a time from the addition of the water to the mixer that the previous lift of

concrete has not commenced setting.

4) Any method involving the use of pipes or chutes for transporting concrete will not be permitted, except with the written approval of the Engineer.

5) Before any concrete is placed, the formwork shall be thoroughly cleaned of all dirt, shavings, loose stones, and other debris.

6) Forms shall be treated with a non-staining material or shall be saturated with water immediately before the concrete is placed. For all exposed surfaces, the forms shall be treated with a non-staining material, as approved by the Engineer, to prevent the adherence to the concrete.

7) The concrete shall be placed gently in position and shall not have a free fall of more than one metre.

8) To convey the concrete as near as possible to its final position, drop chutes of rubber or metal shall be used for small sections and bottom dump buckets or other suitable vessels for large Sections.

9) Concrete shall be placed so as to prevent water from collecting at the ends, corners or along the faces of the forms, and water shall not be placed in large quantities at a given point and allowed to run or be worked over a long distance in the form.

10) All concrete shall be placed and compacted in even layers with each batch adjoining the previous one.

11) The thickness of concrete layers shall be between 15 and 30 cm for reinforced concrete and up to 45 cm for unreinforced concrete.

12) The concrete shall be carefully and continually compacted and worked around the Reinforcing Steel Bar steel without displacing the bars, and into the corners of the formwork so that the concrete shall be in close contact with the Reinforcing Steel Bar steel and free from honeycombing.

13) After initial set of the concrete, the forms shall not be jarred and no strain shall be placed on the ends of projecting Reinforcing Steel Bar steel.

14) The concrete shall be consolidated with approved mechanical vibrators operating within the concrete, of a type approved by the Engineer. When required, vibrating shall be supplemented by hand spading with suitable tools to assure proper and adequate compaction.

15) Over-vibration of concrete in the formwork by means of vibrators will not be permitted.

16) The poker vibrators shall have a diameter compatible with the spacing of the Reinforcing Steel Bar, shall be of sufficiently high frequency, and shall be properly handled by experienced personnel. They shall be immersed at regular intervals of approximately 10 times the diameter of the vibrator and to such a depth that the fresh concrete will be worked into that previously placed. Care shall be taken not to displace the Reinforcing Steel Bar nor to disturb or affect partially set concrete. Vibrators shall not be attached to the Reinforcing Steel Bar in any circumstances. Each immersion shall continue until shortly after air bubbles cease to appear on the surface of the concrete, but shall not last more than 30 seconds. The vibrators shall be withdrawn gradually and vertically to ensure that no air pockets are formed.

17) The Contractor shall provide at least two vibrators and a spare during all concrete pours.

18) The plant used for compaction shall be operated continuously during the placing of each batch of concrete until the expulsion of air has virtually ceased, and in a manner which does not promote segregation of the ingredients.

19) All vibration, compaction and finishing operations shall be completed immediately after the placing of concrete in its final position.

20) Workers shall not be permitted to walk over freshly placed concrete until it has hardened sufficiently to carry their weight without distortion.

21) Care shall be taken to ensure that Reinforcing Steel Bar projecting from recently placed concrete is not disturbed so as to damage the initial set of the concrete.

22) Concreting in any one part or Section of the work shall be carried out in one continuous operation and no interruption of concerning work will be allowed.

23) Where beams and slabs together form an integral part of the structure, they shall be poured in one operation, unless otherwise specified or an approved provision is made to form a construction joint.

24) After a beam, wall or column has been cast, an interval of one hour shall be allowed before casting the continuous slab. The same applies for all abrupt changes in sections.

25) Freshly placed concrete shall be adequately protected from rain, dust storms, chemical attack and the harmful effects of sun, heat, wind, flowing water, vibrations and shocks. It shall also be fenced off or otherwise protected to prevent persons from walking thereon or articles being placed or thrown thereon. This protection shall continue until the concrete is sufficiently set such that it can no longer be damaged by these factors. The Engineer may determine when the protection is no longer required, but in any case this shall not be less than 24 hours after the time of placing.

26) The Contractor shall take all necessary precautions to prevent deferential temperatures across any concrete element not to exceed 200 C during concrete placing and curing.

9.9.5 Chutes and Troughs

1) Concrete shall be placed so as to avoid segregation of the materials and the displacement of the Reinforcing Steel Bar.

2) Where steep slopes are required, the chutes shall be equipped with baffle boards or be in short lengths that reverse the direction of movement.

3) All chutes, troughs and pipes shall be kept clean and free from coatings of hardened concrete by thoroughly flushing with water after each run. The water used for flushing shall be discharged clear of the concrete already in place. The use of aluminum chutes, tremies, troughs, and pipes will not be permitted.

9.9.6 Pumping

Placement of concrete by mechanical pumping will be permitted only if authorized by the Engineer. The equipment shall be so arranged that the freshly placed concrete is not affected by any vibrations. The operation of the pump shall be such that a continuous stream of concrete without air pockets is produced. When pumping is completed, the concrete remaining in the pipeline, if it is to be used, shall be ejected in such a manner that there is no contamination of the concrete or separation of the ingredients.

9.9.7 Weather Precautions

1) Concrete shall be placed at the coolest time of the day, as practicable, and in no circumstances shall the temperature of concrete when placed exceed 32 C.

2) The Contractor shall submit to the Engineer for approval, his proposals to maintain the concrete temperature below 32C and reduce the rate of evaporation during hot weather, including the cooling of mixing water and aggregates, and shading of aggregates and plant.

3) The concrete mixing plant shall be screened and covered as a protection from wind, rain and sun, and similar precautions taken during transporting, placing and curing of the concrete whenever conditions require.

4) Fresh concrete placed at temperatures of > 35C shall be shaded from the direct rays of the sun.

5) Concrete shall not be placed when it is raining. If rain starts, or is imminent, work shall stop and a construction joint formed and curing of placed and finished concrete commenced.

9.9.8 Continuity of Concrete Work

1) The Contractor shall carry out the concreting work in such a manner that the placing of the concrete in any particular Section of the structure shall be executed without any interruption whatsoever from the beginning to the end of the operation. If interruptions are permitted, no fresh concrete shall be deposited on or against the concrete placed before the interruption until the latter is sufficiently set.

2) Particular care shall be taken to ensure that partially set concrete shall not be damaged by any cause.

3) Casting of concrete shall not commence until a sufficient quantity of approved material is at hand to ensure continuity of operation.

4) Concrete work shall not commence until there is sufficient equipment in reserve in case of breakdown.

9.9.9 Records of Concreting

The Contractor shall keep up to date records of the dates and times when concreting is carried out and the weather and temperatures at those times. These shall be available for inspection by the Engineer.

9.10 Placing of Concrete in or under Water

9.10.1 Submissions

Where the Contractor proposes the placement of concrete in or under water, he shall submit full details of his construction method to the Engineer for approval, before proceeding with the work.

9.10.2 Particular Requirements

1) The actual mix proportions and selection of aggregates shall be such as to ensure a resulting concrete with good flow and cohesion characteristics.

2) The cement content shall be 25 percent greater than for a comparable mix for use in dry conditions. The minimum works cylinder strength for all concrete shall be approved by the Engineer for the comparable mixes for use in dry conditions.

3) Tremie pipes shall be smooth bored watertight fitted with quick release joints and have an adequate cross-section for the size of aggregate to be used. Aluminum pipes shall not be used.

4) Bottom opening skips shall be straight sided, perfectly smooth and fitted with externally operated bottom opening double doors and overlapping canvas flaps.

9.10.3 Method

1) The method of placing concrete in or under water shall keep as much as possible of the concrete being placed out of direct contact with the water and avoid any rapid movement or agitation of the exposed surface.

2) The work shall, where possible, be carried out in one operation. Where this is impracticable, laitance, washed-out aggregate or foreign matter, which may have accumulated on the previously placed concrete, shall be completely removed prior to additional concrete being placed. This concrete shall then be placed directly on the cleaned surface.

9.11 Curing

9.11.1 General

1) The Contractor shall prevent excessive rates of evaporation of water from all surfaces due to high temperature and / or drying winds by adequately protecting the concrete.

2) All newly placed concrete shall be cured, and curing shall begin immediately after finishing and continue for a minimum of 72 hours.

3) Curing shall be done so that moisture is always present, and shall be an integral part of the concreting operations. Where water is used, sufficient quantities must be available on Site to ensure that the concrete is continually wet throughout the curing period.

4) Improperly cured concrete will be considered defective, and the Engineer will stop all of the Contractor's placing operations until proper procedures are put into effect.

9.11.2 When permitted in writing by the Engineer, the Contractor may use one of the following methods or a combination thereof:

1) Supplying Additional Moisture

This shall include supplying additional moisture by ponding, sprinkling, or fogging. Coverings such as burlap shall be used to retain water. Coverings shall be placed as soon as possible after finishing operations have been completed and there is no danger of surface damage. The coverings shall be kept continuously moist, and or covered with sheet materials as below.

The use of sawdust will not be allowed and coverings that cause unsightly discoloration of concrete shall not be used. Any method that results in the concrete being alternate wetting and drying and the application of cold water to warm concrete surfaces will be considered an improper curing procedure

2) Preventing Moisture Loss

Preventing moisture loss from the concrete may be done with the use of approved waterproof paper, plastic sheets, or liquid membrane curing compound except where other requirements prohibit the use of these compounds. If a formed surface is to be rubbed, the concrete shall be kept moist before and during the rubbing, and the curing shall be initiated immediately following the first rub while the concrete surface is still moist.

Structure supported during pouring shall be covered with burlap or similar approved as soon as the concrete is sufficiently set to support this material without damage to finish. This moisture-retaining material shall then be saturated with water and the entire area covered with waterproof sheeting.

a. Sheet materials

- Shall conform to AASHTO M 171.
- Waterproof Paper and Plastic sheets shall be the widest practicable width with due allowance for adequate laps of the material, and shall be tightly sealed with a pressure sensitive tape, mastic, glue or other approved methods to form a complete waterproof cover of the entire concrete surface. They shall be

securely positioned so that wind will not displace it. If any portion of the sheets are broken or damaged before expiration of the curing period, the broken or damaged portions shall be immediately repaired. Sections that have lost their waterproof qualities shall not be used.

b. Curing Compounds

- Only curing compound complying with AASHTO M 148 or similar approved may be used as the initial and final curing agents on structural concrete.
- Application shall be by atomising-type spray equipment fitted with a tank agitator.
- Compounds shall be applied to unformed areas as soon as the water sheen has practically disappeared from the concrete, or as soon as the forms have been removed from surfaces not to be rubbed. Curing compounds shall not be used on areas receiving a rubbed finish. If there is to be any delay in applying curing compound, the surface shall receive moist curing until the compound can be applied.
- If the membrane film is broken or damaged at any time during the curing period, the area or areas shall be immediately re-coated to the original requirements.
- The surface shall be sprayed again immediately at right angles to the first application. The rate of each application shall be not less than 1 litre for each 3.6 square metres of surface. Care shall be taken to prevent application to joints where concrete bond is required to Reinforcing Steel Bar, and to joints where joint sealer is to be placed.
- Liquid curing membranes shall not be applied while rain is falling.

c. Forms

- Timber formwork covering the concrete shall be moistened with water at frequent intervals to keep it from drying during the curing period. Metal formwork exposed to the sun must be shaded from its direct rays, painted white or otherwise protected during the curing period. When the Engineers approval is given to remove forms early, specified curing procedures shall be implemented by the Contractor and continued until the end of the 7-day period as specified.

9.12 Built-in Items

9.12.1 Where pipes, sleeves, water bars or other items are built into concrete, they shall be rigidly secured in position to prevent movement and shall be free from external coatings which might reduce the bond. The Contractor shall take precautions to prevent the formation of air pockets, voids or other defects whilst the concrete is being placed.

9.12.2 Where pipes or other built-in items are built into or pass through walls, floors or roofs of concrete structures, the Contractor shall apply details and select methods to sustain the integrity and where necessary the watertight nature of the structure. All such details and methods shall be submitted to the Engineer for approval.

9.12.3 The Contractor shall cast pipes or other built in items into the concrete as the work proceeds unless the Engineer exceptionally agrees to the formation of box-outs. Box outs will generally not be allowed in watertight construction or in concrete requiring Class F3 or F4 finish.

9.12.4 For box-outs, the clearance between the outside of the pipe and the structural concrete shall be between 50 and 200 mm and a continuous approved water bar shall be provided or as indicated in drawing. Clearance to cut Reinforcing Steel Bar shall be at least 40 mm.

9.12.5 Before casting any concrete around pipes or other built-in items, the Contractor shall provide approved puddle flanges to the item and/or hydrophillic strip, correctly fitted to or around the pipe or built–in at the centre of the wall. If there is a flange around the pipe the hydrophillic strip shall be on the pressure side of the flange.

9.13 Tolerances

9.13.1 Concrete surfaces in the final work shall have no abrupt irregularities to an extent noticeable to the eye.

9.13.2 Subject to the tolerance requirements of a particular Section and providing the required concrete cover to Reinforcing Steel Bar, the tolerances listed in Tables 9– 10 below, are the maximum permissible from the dimensions indicated on the drawings to be used for acceptance of the work.

Table 9 - 10

Item		**Tolerance in mm unless indicated otherwise**
Placing of Reinforcing Steel Bar		5 controlled by cover, half bar otherwise
Placing of post-tensioning sheathing		5
Concrete cover		0 to +5
Footings		0 to +5
Plan dimensions	Formed footings and pile caps	- 15 to +50
	Unformed footings	0 to +150
Thickness	< 300 mm	-5 to +25
	> 300 mm	-10 to +50
Reduced level of top of footing or pile cap		-25 to +25
Departure from the plan position		50
Cylinders		
Variation from the vertical		25 mm in 3 m
Departure from the plan in any direction		75
Variation in cross section of Columns, piers, Crossheads, Slabs, Walls, Beams and similar (not deck slabs and end posts)		
< 3 m		-5 to +15
> 3 m		-10 to +25
Variation of Cross section of End posts		-5 to +5
Deck		
Thickness of Deck Slabs (excluding camber or hog allowance)		0 to +10
Deck Surface reduced level		-10 to +10
Deck Joints		
Width of slot		-3 to +3
Variation from vertical or Specified Batter of Columns, Piers, Walls, handrail Posts and Arrises		
Unexposed Concrete		10 mm in 2.5 m
Exposed Concrete		5 mm in 2.5 m
Variation from Grades Indicated on Drawings for		2.5 mm in 2.5 m

Item	Tolerance in mm unless indicated otherwise
Railings, Kerbs and Arrises	
Reduced Level of Tops of Crossheads and Piers	
With pedestals	-10 to +10
Without pedestals	-5 to +5
Difference in level across width of crosshead	5
Bearing Pedestals	
Reduced level	-2.5 to + 2.5
Variation in grade across width of individual pedestals shall not exceed	1 in 200
Deviation from flat surface	+1.0 to –1.0
Departure from Plan Position at any level	
Columns, Piers, Walls, Crossheads, Beams, Slabs, Kerbs, Railing and other similar parts	25
Relative displacement of adjoining components shall not exceed	10
Departure from alignment	
Rows of columns, faces of piers or walls	10
Handrails, faces of handrail posts, kerbs	5
Maximum allowance for Irregularities in Exposed Concrete Surfaces	
Divisions less than 1 m in dimension when measured with a straightedge across the dimension of the Division	2.5
Sections greater than 1m in dimension when measured with a straightedge across the dimension of the Section, except that when sections are greater than 2.5 m in dimension , a 2.5 m straightedge shall be used	5
Irregularities in Railings	2.5 mm in 2.5 m
Slab Surface Finish	5 mm in 2.5 m
Built-in Items	
Line, level and protrusion from wall surface	± 5 mm
Angular orientation of flanged pipes within specified	0.5^{O}
Position of bolt holes in pipe flanges within specified	0.5^{O}

9.14 Measurement and Rate

9.14.1 Measurement

1) Measurement and payment for the items of concrete construction will be as described herein and as included in the bills of quantities. The work included under the respective items enumerated in the bill of quantities shall include all labor, materials, tools, equipment and appurtenances to complete the respective items.

2) Curing, joints, concrete finishing, placing concrete, testing, weep holes, waterstop and grout pads and fiber optic cable supports, shall be considered a subsidiary obligation to applicable items of the Bill of quantities and no separate measurements and payment will made to these items.

3) For precast concrete items, including those that are dressed in other specification sections measurement and payment will be by the number and type furnished, erected

and accepted in accordance with specification requirement and requirements of the Drawings. All work required for the manufacture and erection shall be included in the rates as indicated in the Bill of quantities.

4) Measurement for the various classes of concrete and in the various locations will be by the cubic meter in place as indicated on the Drawings and as described in the bill of quantities. Measurements will be made to the neat lines of the structures as indicated on the Drawings. No deduction will be made for the volume occupied by reinforcement steel bars, structural or other items embedded in concrete.

9.14.2 Rate

Payment for the items of concrete [of the various classes of concrete and the various locations as indicated on the Drawings, as described in the Bill of quantities] shall be paid for in accordance with applicable unit prices as indicated on the bill of quantities. Payment shall be considered as full compensation for all labor, materials, tools, equipment, and appurtenances to complete the concrete items.

Section 10 – Reinforcing Steel Bar

10.1 Scope of Specification

10.1.1 The work under this Section consists of the requirements for Reinforcing Steel Bar to Concrete.

10.2 Materials

10.2.1 General

Reinforcing Steel Bar shall comply with the relevant provisions of the following standards:

Table 10 – 1

Type	Standard		
	JIS	AASHTO / ASTM	BS
Carbon Steel bars	G 3112	M31 / A 615	4449
Cold reduced steel wire	G 3532	A 82	4482

10.2.2 Reinforcing Steel Bars

Reinforcing Steel Bars shall be:

1) Deformed high yield steel, with a minimum yield strength of 400 N / mm^2 for bridge structure and
2) Plain round Reinforcing Steel Bars with a minimum yield strength of 300 N / mm^2 for bridge structure
3) Compliance shall be proved by the Contractor by testing in accordance with the appropriate standard.
4) Hot rolled or cold worked high tensile steel bars shall not be used in the same structural member.

10.2.3 Tying Wire

Tying wire for Reinforcing Steel Bar shall be 1.6 mm diameter finally annealed mild steel wire, complying with BS 1052 or equivalent.

10.2.4 Dowel Bars

Dowel bars for expansion and construction joints in concrete shall consist of plain round bars, minimum 300 N / mm^2 with a fusion bonded epoxy coating or galvanised as indicated on the drawings or approved by the Engineer.

Dowel bars shall be straight, free from burrs or other irregularities and shall have their sliding ends sawn. The sliding half of each dowel bar shall be provided with a close fitting plastic or waterproof cardboard cap at least 100 mm long, the end 20 mm of which shall be fitted with a disc of joint filler or a pad of cotton waste.

Dowels shall project a minimum of 10 bar - diameters unless otherwise indicated on the Drawings. Metal supports which extend to the surface shall not be used. Placing bars on layers of fresh concrete as the work progresses and adjusting bars during the placing of concrete will not be permitted by the Engineer.

10.3 Steel Quality and Supply

10.3.1 Representative samples of all Reinforcing Steel Bar that the Contractor proposes to use in the Works must be submitted, to the Engineer for his written approval, before work is commenced together with:

1) Manufacturer's certificates stating clearly for each sample the place of manufacture.
2) The expected date and size of deliveries to the Site.
3) All relevant details of composition, manufacture, strengths and other qualities of the steel.

10.3.2 In the event that a Reinforcing Steel Bar sample under test fails to meet the specification requirements at any time, or the Engineer considers that samples which were presented to him for test were not truly representative, or if it becomes apparent that Reinforcing Steel Bar which has not been approved has been used on the Works, the Engineer may instruct the Contractor to break out and remove completely all such Divisions of the work already constructed using such suspect Reinforcing Steel Bar steel.

10.3.3 All testing of Reinforcing Steel Bar shall meet the requirements and specification limits of the British Standard designation for the particular size, grade and any additional requirements.

10.4 Substitution

10.4.1 Substitution of different grades or size of bars will be permitted only upon specific written approval by the Engineer, and the substitute bars shall provide a steel area equal to or larger than that called for in the design or design requirements or on the drawings.

10.4.2 Substitution of bars types, designated by number not equivalent in area (to mm bars) shall be closest number bar in area with spacing adjusted to provide the same area per unit spacing. Substitution of millimetre bars for bar sizes not readily available from the Contractor's source may be made on the same basis. All bar substitutions shall be approved by the Engineer in writing.

10.5 Scheduling

10.5.1 Bar lists and bending diagrams

The Contractor shall submit detailed bar bending schedules and if necessary diagrams in accordance with BS 4466 to the Engineer for review and approval. Fabrication of material shall not begin until the schedules have been approved. The approval of these schedules shall in no way relieve the Contractor of responsibility for the correctness of such information. Any expense incident to the revision of material furnished in accordance with such lists and diagrams to make it comply with the design drawings shall be borne by the Contractor.

10.5.2 The Contractor shall provide details of the location, spacing and type of spacers and chairs to Reinforcing Steel Bar that he intends to use for the approval of the Engineer.

10.6 Fabrication

10.6.1 Bending

Reinforcing Steel Bar shall be cut and bent to the shapes shown on the Reinforcing Steel Bar drawings and schedules. Fabrication tolerances shall be in accordance with BS 4466. Bending of bars shall be without the application of heat, unless otherwise permitted. Bending shall achieve a substantially constant curvature. Reinforcing Steel Bar shall not be straightened or re-bent without the approval of the Engineer. If permission is given to bend

projecting Reinforcing Steel Bar, measures shall be taken to prevent damage to the concrete and to ensure that the radius is not less than the minimum specified in BS 4466.

The Contractor shall make provision on Site for bending steel from stock to accommodate minor variations in Reinforcing Steel Bar details.

10.6.2 Bends and Hook Dimensions

The dimensions of hooks and the diameters of bends measured on the inside of the bar shall be in accordance with the minimum recommendations of BS 4466: Table 3.

10.7 Laps and Joints

10.7.1 General

All Reinforcing Steel Bar shall be furnished in full lengths indicated on the drawings unless otherwise approved by the Engineer. Laps and joints shall be staggered as far as possible, and only made at the positions described in the Contract or as agreed by the Engineer.

10.7.2 Laps

Laps shall be of the lengths shown on the drawings or in accordance with the design criteria. If not shown, the length of laps shall be no less than 20 bar diameters or 300 mm, whichever is the greater for bars, and 250 mm for fabric. Lap lengths for unequal size bars is based on the larger bar.

At lapped locations, the bars shall be placed and wired in such as manner as to maintain the minimum distance to the surface of the concrete indicated in the Specification.

10.7.3 Welding of Reinforcing Steel Bar

Reinforcing Steel Bar shall not be welded on Site except where described or permitted under the Contract. All welding procedures shall be subject to the prior approval of the Engineer in writing, and be in accordance with the recommendations of BS 8110. Part 1, 3.12.8.

10.7.4 Mechanical Coupler for Butt Joints

For bars in compression the load may be transferred by end bearing of square sawn-cut ends held in concentric contact by a suitable sleeve or other coupler agreed with the Engineer. The concrete cover for the sleeve should not be less than that specified for the Reinforcing Steel Bar.

For bars in tension splices shall only be made if pre-approved or detailed on the drawings or authorized in writing by the Engineer, with a mechanical coupler satisfying the following criteria.

The tensile strength of the coupled bar should not increase by more than 10% for plain bars, 5% for deformed bars.

When requested by the Engineer, up to two field splices out of each 100, or portion thereof, placed in the work and chosen at random by the Engineer, shall be removed by the Contractor and tested.

10.8 Handling

Rough handling, shock loading and the dropping of Reinforcing Steel Bar from a height is to be avoided from the time of shipment until it is placed, together with measures to safeguard surface deterioration from rusting or other causes. Reinforcing Steel Bar stored at the site shall be laid on wood floors or sills suitably spaced so that no Reinforcing Steel Bar shall be laid upon or come in contact with the ground. When the weather is dry and the time for storage before installation is limited, housing may be omitted, but if rainy or exceptionally

humid weather occurs or is anticipated, bars shall be stored under cover.

10.9 Fixing and placing

10.9.1 The Reinforcing Steel Bar shall be assembled to the shapes and dimensions as indicated on the Drawings. The bars shall be of the cross-sectional areas indicated and shall be fixed rigidly and accurately in the forms in the positions indicated on the Drawings. The bars shall be firmly bound together at intersections to ensure that the Reinforcing Steel Bar framework as a whole shall retain its shape, and the framework shall be so temporarily secured against displacement as to retain its correct position in the forms during the process of depositing and consolidating the concrete.

10.9.2 Non-structural connections for the positioning of Reinforcing Steel Bar shall be made with tying wire or other fixing devices. Precautions shall be taken to ensure that the ends of clips or ties are turned into the main body of the concrete and not allowed to project towards the surface or encroach into the concrete cover.

10.9.3 Spacing blocks shall be of precast concrete of strength at least equal to that of concrete being placed. They shall be as small as practicable and shall be securely fixed in position by means of wires cast into them. They shall be soaked with water immediately prior to concreting.

10.9.4 No temporary metal supports to the Reinforcing Steel Bar will be allowed by the Engineer to be incorporated in the finished concrete, and metal clips or supports shall not be placed in contact with forms for exposed surfaces.

10.9.5 At the time of concreting, all Reinforcing Steel Bar shall have been thoroughly cleaned and freed from all loose rust, scale, mud, oil or any other coatings that might adversely affect the steel or concrete chemically or reduce the bond and it shall also have been cleaned of all set or partially set concrete which may have been deposited thereon during the placing of a previous lift of concrete.

10.9.6 The placing of all Reinforcing Steel Bar will be checked by the Engineer and in no case is concrete to be placed around any Reinforcing Steel Bar that has not been approved by the Engineer. The insertion of bars into or the removal of bars from concrete already placed will not be permitted by the Engineer. Reinforcing Steel Bar temporarily left projecting from the concrete at the joints shall not be bent without the prior approval of the Engineer.

10.9.7 Main Reinforcing Steel Bar carrying determinate stresses shall be spliced only where indicated on the Drawings or on approved shop drawings.

10.9.8 The minimum spacing centre to centre of parallel bars shall be 2.5 times the diameter of the bar, but in no case shall the clear distance between the bars be less than 1.5 times the maximum size of the coarse aggregate.

10.9.9 Bundles of Reinforcing Steel Bar shall be tied together at not more than 1.80 m centres.

10.9.10 All Reinforcing Steel Bar shall have the clear concrete cover as indicated on the Drawings or specified herein.

10.9.11 The cover to Reinforcing Steel Bar cover shall be not less than the required cover minus 5mm and, where Reinforcing Steel Bar is located in relation to only one face of a member, not more than the required cover plus:

a. 5 mm for bars up to and including 12 mm size

b. 10 mm for bars over 12 mm up to and including 25 mm

c. 15 mm for bars over 25 mm size

10.9.12 General limits on bar sizes and spacing of bars shall be as indicated on the Drawings.

10.9.13 Reinforcing Steel Bar which temporarily or otherwise projects from work being concreted or already concreted, shall be adequately supported and should not be bent out of position or in any way disturbed unless agreed in writing with the Engineer. Reinforcing Steel Bar left projecting at a temporary end, which because of a lapse of time between first and second stages of the work is likely to corrode, shall be protected by a thin coat of cement wash. Loose cement shall be cleaned off the bars before concreting the next stage.

10.9.14 The spacing between adjustment bars and the distance between layers of bars may not vary from the indicated position by more than one bar diameter nor more than 25mm.

10.10 Measurement and Rates

10.10.1 Measurement

Reinforcing steel bars shall be measured according to the pay items and units, included in the Bill of Quantities.

10.10.2 Rates

1) Reinforcing steel bars shall be priced according to the pay items and units included in Bill of Quantities.
2) Rates shall be fully inclusive of all the requirement of this Section of the specification and of all other Relevant Specifications.
3) The rates quoted by the Contractor in the bill of quantities shall include work to be executed under these specifications in any floor and any height except where otherwise specifically state in the relevant item of Bill of Quantities and the Contractor shall not be entitled to any claim or claim any compensation on this account.
4) Rates for Reinforcing steel bars shall particularly include for:
    a. Installing cover blocks, chairs, supports, hook, spacers, binding wires and lap not shown in the drawings including wastage and rolling margin. Laps shown in the drawings shall be payable.
    b. All lead/lift required for steel fabrication and placement at/in any floor and any height.
    c. All laboratory test charges for Reinforcing steel bars

Section 11 – Formwork/ Finishing

11.1 Scope of Specification

11.1.1 The work under this Section consists of furnishing all plant, labor, equipment, appliance and materials and in performing and operating in any floor and at any height in connection with the supply and installation of formwork for the purpose of shuttering in concreting works, complete in strict with this Section of Specification and the Drawings and subject to the terms and conditions of Contract.

11.2 Design

11.2.1 All formwork shall be the responsibility of and be designed by the Contractor.

11.2.2 Formwork generally be in accordance with the recommendations of BS 5975 or similar approved.

11.2.3 The Contractor shall submit shop and working drawings, calculations, proposed materials and manufactured goods, to the Engineer for approval at least 3 weeks before construction of the forms.

11.2.4 The shop and working drawings shall show the proposed details of construction such as sizes of members, spacing of bents, posts, studs, whalers, stringers, collars, bolts, wedges, bracing, rate of pour, and the manufacturer's recommended safe working capacity of all form ties and column clasps. All assumptions, dimensions, material properties and other data used in the structural analysis shall be noted on the shop drawings.

11.2.5 If retarding admixtures are proposed, their effect shall be duly considered in the calculation of the lateral pressures of the fresh concrete. Besides the weight of the formwork and freshly placed concrete, the design loads shall include the weight of workmen, equipment, runways and impact, which together should be taken as not less than 250 Kg/m^2 of horizontal projection. Braces and shoring should be designed to resist all foreseeable lateral loads.

11.2.6 When prefabricated formwork, shoring or scaffolding units are used, the manufacturer's recommendations for allowable loads may be followed if supported by test reports or successful experience records. For materials subject to substantial reuse, reduced allowable load values may be required at the discretion of the Engineer.

11.2.7 The design of the formwork and bracing shall be such that there is no deformation of the forms under the weight of the plastic concrete, or due to methods adopted for the placing and compacting thereof, or due to any incidental loading. No accessory for supporting the formwork or stagings shall be built into the permanent structure except with the Engineer's approval.

11.2.8 The formwork shall be sufficiently rigid and tight to prevent loss of mortar from the concrete and to maintain the correct position, shape and dimensions of the finished work. It shall also be so constructed as to be removable from the cast concrete without shock or damage.

11.2.9 The forms shall produce a consistent colour and quality of surface.

11.2.10 Where holes are required in forms to accommodate projecting Reinforcing Steel Bar, fixing devices or other built-in items, precautions shall be taken to prevent loss of mortar matrix.

11.2.11 Formwork shall allow access for the preparation of joint surfaces before the concrete has hardened.

11.2.12 For the purposes of compliance with the provisions of Clause 8 of this Section - Striking of Formwork, the Contractor's method of constructing formwork shall allow for the props to soffit forms, to remain in position continuously for the period described.

11.2.13 25 mm x 25mm chamfers shall be provided on all exposed arrises, except for weir walls, rebates for grouted in items, unless otherwise indicated on the Drawings.

11.3 Materials

11.3.1 Generally:

1) General quality plywood is to be in accordance with BS 6566; thickness minimum 12 mm; WBP bonding
2) High quality plywood is to be marine quality in accordance with BS 1088; joinery grade finish.
3) All plywood used for formwork to temporary or permanent works on potable water supply structures shall be either phenol free or faced with a surfacing which prevents phenol from coming into contact with concrete on the potable water faces.

11.3.2 Formwork for Ordinary Finish

1) General quality plywood, or
2) Sawn timber boarding
3) Reasonable re-use is allowed

11.3.3 Formwork for Fair Finish

1) Steel sheet, or
2) High quality joinery grade plywood, to give flat non-textured finish, or
3) Planed timber to give flat non-textured finish,
4) Flush joints, suitably finished to prevent any distortion, line or imprint upon concrete.
5) Re-use shall if allowed, shall be strictly controlled to maintain constant quality of finish.

11.4 Construction

11.4.1 The formwork shall be constructed accurately to represent the shape of the concrete as detailed on the Drawings. It shall be of suitable design and substantial construction and be approved by the Engineer. The Contractor shall make any necessary adjustments to allow for shrinkage, settlement or deflection, which may occur during construction so that the finished concrete sections conform accurately to the specified finish and dimensions true to line, level and camber.

11.4.2 Unless indicated otherwise or required by the Engineer, blinding concrete will be placed to a minimum depth of 50 mm in the foundation of footings of structures to provide a working platform and to protect the stability of the foundation soils at the expense of the Contractor. The area shall be sufficient size and adequate strength to provide support for formwork.

11.4.3 Any formwork that becomes damaged or distorted prior to placing of the concrete will be rejected.

11.4.4 Forms for all exposed surfaces shall be constructed with new plywood or metal on the face of the form that will be in contact with the concrete. The surfaces of these forms shall be maintained equal to the new surfaces at all times as needed to produce the desired concrete surface. The form faces shall be replaced, as required by the Engineer.

11.4.5 Unless otherwise described in the Contract, all formwork joints for exposed surfaces of concrete shall form a regular pattern with horizontal and vertical lines continuous throughout each structure and all construction joints shall coincide with these horizontal or vertical lines.

11.4.6 All exposed sharp edges except for weir walls or rebates for grouted in items, shall be chamfered with triangular fillets not less than 25 mm by 25 mm unless otherwise directed by the Engineer. The triangular fillets or chamfer strips shall be milled from clear, straight grain timber and shall be surfaced on all sides. Curved surfaces shall be formed of plywood, metal, or other suitable material.

11.4.7 Form clamps or bolts shall be used to fasten forms. Bolts or form clamps shall be positive in action and shall be of sufficient strength and number to prevent spreading of the forms. Lifting anchors may be installed in precast members. Bolts, form clamps and lifting anchors shall be of such type that they can be entirely removed or cut back 2 cm or more below the finished surfaces of the concrete, leaving no metal within 3 cm of the concrete surface. All forms for the outside surfaces shall be constructed with stiff whales at right angles to the studs and all form clamps shall extend through and fasten such whales.

11.4.8 No concrete shall be deposited in the forms until all work connected with constructing the forms and placing all Reinforcing Steel Bar, ducts, anchorages, or pre-stressing steel has been completed for the unit to be poured and the Engineer has given written approval of said forms, Reinforcing Steel Bar, ducts, anchorages, or pre-stressing steel.

11.4.9 Drainage holes and weep holes shall be constructed as detailed on the Drawings. Forms for weep holes shall be as approved by the Engineer.

11.4.10 The Contractor shall install in the formwork required inserts, anchors, expansion joint elements, sleeves, and other items specified under other Sub-sections of this Specification and shall coordinate installation with other trades in the proper location of such items. Ends of piping and sleeves embedded in concrete shall be closed with caps or plugs.

11.4.11 To facilitate finishing, forms used for parapets, barriers, and exposed vertical surfaces shall be removed in not less than 24 hours nor more than 48 hours, depending on weather conditions.

11.5 Sloping Formwork

Top formwork shall be provided to slopes 30^{o} or more from the horizontal

11.6 Tie Bolts for Formwork

11.6.1 Only tie bolts that avoid embedding any metal parts permanently within 50 mm of the concrete surface shall be permitted. Voids remaining after the removal of all or part of each tie bolt shall be filled flush with the surrounding concrete using a freshly prepared cement and fine aggregate paste.

11.6.2 In the case of Liquid Retaining Structures, the Contractor shall ensure that the measures adopted shall not impair the water tightness of the structure.

11.7 General Requirements

11.7.1 The interiors of all forms shall be thoroughly cleaned out before any concrete is placed.

11.7.2 The inside surfaces of forms shall, except for permanent formwork, or unless otherwise agreed by the Engineer, shall be coated with a release agent approved by the Engineer. Release agents shall be applied strictly in accordance with the manufacturer's instructions, applied evenly and shall not come into contact with the Reinforcing Steel Bar or pre-stressing tendons and anchorages. Different release agents shall not be used in formwork to concrete which will be visible in the finished Works.

11.7.3 Where the concrete surface is to receive an applied finish, care shall be taken to ensure the compatibility of the release agent with the finish.

11.8 Striking of Formwork

11.8.1 The Contractor shall give a minimum of 1 working days notice to the Engineer of his intention to strike formwork.

11.8.2 Formwork shall be removed without shock to or disturbance of the concrete.

11.8.3 Materials shall not be placed on any new construction in such a manner as to cause damage.

11.8.4 Formwork to vertical surfaces or sloping formwork not supporting concrete in flexure shall not be removed until, the concrete strength shall be sufficient to meet any wind loading upon the concrete likely to arise at the time when the formwork is removed; and

The concrete strength (as confirmed by tests in cubes cured under representative conditions) has reached 5 N / mm^2 or;

For concrete containing only, in the absence of cube test results a minimum period shall have elapsed since the concrete was poured equivalent to 8hrs at 20^0C for unsealed plywood forms, or 6 hrs for impermeable forms.

11.8.5 Formwork supporting concrete in flexure shall not be removed until:

The concrete strength (as confirmed by tests on cubes cured under representative conditions) has reached 10 N / mm2, or twice the stress to which the concrete will then be subjected, whichever is the greater or;

For concrete containing only, in the absence of cube test results or any formal procedure agreed in writing with the Engineer, the periods before striking shall be in accordance with the following, Table 12- 1;

Table 12– 1

Type of Formwork	Minimum period before striking, for Concrete
Vertical formwork to columns, walls and large beams	1 day
Soffit formwork to slabs	4 days
Soffit formwork to beams and props to slabs	10 days
Props to beams	14 days

11.8.6 The Contractor shall submit specific proposals for striking formwork to the Engineer, with particular reference to variations in cement or admixtures, or to the following factors:

a. Concrete strength.

b. Stresses in the concrete at any stage in the construction period which, in the case of precast units includes the stresses induced by disturbance at the casting position and subsequent handling.

c. Curing.

d. Subsequent surface treatment finishes.

e. Presence of re-entrant angles requiring formwork to be removed as soon as possible after concrete has set, to avoid thermal cracking.

11.9 Insulation Against Thermal Cracking

11.9.1 The Contractor shall control thermal cracking of concrete on sections greater than 500 mm thick by using insulation or formwork or both to prevent rapid heat loss from the surfaces as directed by the Engineer.

11.9.2 The Contractor shall not strike formwork or remove insulation until the temperature of the concrete has fallen to a level such that the difference in temperature between the inside and outside surface is less than 20^0C. Unless the Engineer agrees otherwise in writing the Contractor shall use thermocouples to measure temperature differences on all concrete Divisions more than 500 mm thick.

11.9.3 The use of temperature differential monitoring equipment will accurately determine when the insulation / formwork can be removed. Thermocouples shall be located at the centre and at the surface to measure the temperature extremes and hence the maximum differential.

11.9.4 Where the Engineer agrees to allow the Contractor not to use thermocouples the following table shall be used:

Table 12 – 2

Pour Dimension Thickness (m)	Minimum Period of Insulation (Days)
0.5	3
1.0	5
1.5	7

11.10 Concrete Finishing - Surface Finishes produced with formwork

11.10.1 All concrete shall be given a surface finish, according to the requirements of this Section or as required by the Engineer.

11.10.2 The following standard of concrete finish to formed surfaces shall be achieved unless approved otherwise by the Engineer:

Table 12 - 3

Surface	Required Finish
All surfaces (including soffits) of bridge and roadside structures, on view to the general public, including exposed surfaces of precast items and pre-stressed concrete bridge girders, beams and the like.	Fair worked finish Class F4
Externally exposed surfaces of Liquid Retaining Structures, and other structures in plants, culverts or the like, not on view to the general public, and Surfaces of other precast and pre-stressed concrete members.	Fair worked finish Class F3
Buried external vertical surfaces from 300 mm below finished ground level	Fair finish Class F2 when reinforced Ordinary finish Class F1 when not reinforced
Exposed walls and ceilings of occupied rooms	Fair worked finish Class F3.
Exposed internal surfaces of chambers, culverts	Fair finish Class F2
All other vertical, horizontal and sloping surfaces	Fair finish or fair worked finish as designated on the Drawings or instructed by the Engineer

11.10.3 The Engineer shall require sample panels to be provided for all types of finish.

11.10.4 The type of surface finishes shall be as follows:

1) Class F1 – Ordinary Finish

   a. No particular finish requirements are prescribed. The finish in this category shall generally correspond to concrete surfaces to receive further treatment, or of no visual merit, or expressly suitable to their function with workmanship as approved by the Engineer.

   b. This finish shall be obtained by the use of moulds or properly designed forms of ordinary plywood or closely jointed sawn boards. The surface shall be free from substantial voids, honeycombing or other large blemishes.

2) Class F2 – Fair Finish

   a. This finish is to concrete structures requiring serviceability and structural soundness, with surfaces, which are not visually important.

   b. This finish shall be obtained from forms designed to produce a hard smooth surface with true clean arrises. Only very minor surface blemishes shall be permitted and there shall be no staining or discoloration. Any projections shall be removed and the surface made good.

   c. Any surface blemish must not penetrate more than 5 mm into the concrete. The area of an isolated surface blemish must not be more than 100 mm2. The total area of all the blemishes on the face of a particular pour must not be more than 2% of the total surface area of that pour.

   d. The finish is intended to be left as struck but imperfections such as fins and surface discoloration shall, if required by the Engineer, be made good by methods approved by the Engineer.

3) Class F3 – Fair Worked Finish

   a. This finish is to concrete structures requiring serviceability and structural soundness, with surfaces, which are visually important.

   b. This finish shall be obtained by first producing a F2 Finish and the Contractor shall make good any imperfections in the finish as required by the Engineer by then filling all surface blemishes with a fresh, specially prepared cement and fine aggregate paste whilst the concrete is still green where possible. After the concrete has been properly cured, the faces shall be rubbed down, if required, to produce a smooth and even surface. If the surface is to be exposed in the final work, filling material shall match the colour of the concrete.

   c. The formwork shall be steel work or lined plywood as approved by the Engineer to provide a smooth finish of uniform texture and appearance.

   d. This material shall leave no stain on the concrete and shall be so joined and fixed to it's backing that it imparts no blemishes. It shall be of the same type and obtained from only one source throughout any one structure.

   e. Internal ties and embedded metal parts will be allowed but only if these ties are positioned in rebates or in other concealed positions as approved by the Engineer.

4) Class F4 – Fair Worked Finish

   a. This finish is to concrete structures requiring serviceability and structural soundness, with surfaces, which are visually particularly important, such as surfaces which are visible to the general public.

b. The requirements for Class F4 are as for Class F3 except that internal ties and embedded metal parts will not be permitted.

11.10.5 Permanently exposed concrete surfaces to Classes F4, F3 and F2 finish shall be protected from rust marks, stains and damage of all kinds.

11.10.6 Unless otherwise instructed by the Engineer or described in the Contract, all formwork joints for exposed surfaces of concrete to Class F2, F3 and F4 finish shall form a regular pattern with horizontal and vertical lines continuous throughout each structure and all construction joints shall coincide with these horizontal or vertical lines.

11.11 Concrete Finishing - Surface finishes produced without formwork

11.11.1 The following standard of concrete finish produced without formwork shall be achieved:

a. Top surface of walls, benching and weir walls and other surfaces to good quality concrete, required for serviceability, structural soundness and appearance – steel trowel finish.

b. Where the type of finish is not given, hidden surfaces shall be screeded finish and exposed surfaces steel trowel finish.

11.11.2 All surfaces shall be protected after finish is formed.

11.11.3 The type of surface finishes shall be as follows:

1) Class U1 – Screeded Finish: Surfaces to receive further treatment or of no visual merit.

The concrete shall be levelled and tamped with a screed and guide boards to produce either a uniform plain, textured or ridged surface. No further work shall be applied to the surface unless it is used as the first stage for a Clause U2 (Steel Trowel) or Clause U3 (Steel Trowel and Float) finish.

2) Class U2 – Steel Trowel – surfaces to receive sheet finishings, or where a regular smooth surface is required, but appearance is not of prime importance.(e.g. Internal surfaces of tanks, pits or similar containment structures)

After the concrete has hardened sufficiently, the concrete U1 surface shall be floated by hand or machine under light pressure to produce a uniform surface free from screed marks and surface irregularities.

3) Class U3 – Steel Trowel and Float Finish – surfaces where appearance is important (e.g. surfaces of exposed concrete which are visible in the completed Works.

After the concrete has hardened sufficiently, the concrete U1 surface shall be floated by steel power float to produce a uniform smooth, dense and uniform surface free from screed and trowel marks and surface irregularities. Inaccessible areas shall be finished by steel trowel.

11.11.4 Tamping for Class U1 Finish, shall be undertaken using approved wooden or metal screeds/tamps of suitable size with guide boards or use of side forms to maintain dimensional control. The concrete shall not be over-worked causing damage to the surface. The surface shall have no ridges or steps and where necessary shall be suitable to receive a mortar screed or similar finish. Screeds/tamps may be manual or mechanical.

11.11.5 Power Floating

1) Power floating shall be undertaken with approved type of rotating steel power floats. The maximum tolerance may not exceed +/- 6mm in 4.0m.

2) If power floated floors are to receive a specified floor finish and because of inadequate finishings or protection, or if the surface of the concrete is not suitable to receive the

specified flooring material, it shall be made good by application of a thin leveling compound at the expense of the Contractor to the approval of the Engineer.

11.11.6 Surface finish, which is to receive sheet membrane waterproofing, shall be Class U2 or U3, to an accuracy such that when tested with a 3m straight-edge, the maximum depression shall not exceed 10mm.

11.12 Remedial Treatment of Finished Surfaces

11.12.1 Any remedial treatment to finished surfaces shall be agreed with the Engineer following inspection immediately after removing the formwork and shall be carried out without delay.

11.12.2 Any concrete, the surface of which has been treated before being inspected by the Engineer, shall be liable to rejection.

11.12.3 All making good of surfaces shall be carried out within 48 hours of striking formwork unless directed otherwise by the Engineer.

11.12.4 The Contractor shall submit proposals, including materials and method to the Engineer for preparation and repair of concrete surfaces within 12 hours of striking formwork if required to do so by the Engineer.

11.12.5 The Engineer shall require a test panel in all cases where he considers the size of the repair requires it.

11.12.6 All surfaces to be made good shall be carefully prepared in order to provide a good bonding surface. This preparatory work may involve cutting out, chipping, wire brushing, air blowing and drying to remove curing membranes etc.

11.12.7 Water-retaining concrete surfaces

a. All making good of water-retaining concrete surfaces shall be carried out using Phenol-free epoxy resin composition.

b. This material shall be a two part mortar pack which shall be mixed and applied strictly in accordance with the manufacturers instructions.

c. All materials shall be approved for use in contact with potable water.

11.12.8 Other concrete surfaces

a. Making good of other concrete surfaces shall be carried out by methods and using materials instructed by the Engineer.

b. The Engineer shall check the repaired surface for texture, density, soundness and colour. The Contractor shall experiment with trial mixes to achieve a colour / texture match to the original surfaces that is acceptable to the Engineer.

11.13 Inferior or Faulty Work

In the event that any member or portion of the concrete work proving, after removal of the formwork, to be of inferior workmanship or to be in any way whatsoever defective, or should crushing tests on samples taken from the work show that the concrete used therein is of inferior quality, such work shall, at the discretion of the Engineer, be cut out and replaced at the expense of the Contractor

11.14 Measurement and Rate

11.14.1 Measurement

Formwork shall be measured by the number of square meters of the several classes of surface

finish formed and accepted. In computing quantities the dimension used shall be shown on the Drawings or ordered in writing by the Engineer. Formworks shall not be measured to construction joints (whether shown on the Drawings or not), holes, ducts, pockets and the like not exceeding 0.15 cubic meter each volume, individual fillets, chamfers, splays, drips, rebates, recesses, grooves and the like of 100mm total girth or less when measured overall the faces in contact with the concrete to the edge of blinding concrete 75mm or less in thickness and unformed surfaces.

11.14.2 Rates

Formwork measured as provided above for several classes of surface finish specified, shall be paid for at the unit price per square meter stated in the Bill of Quantities. The payment shall be full compensation for furnishing, placing and removal of all formwork and false work, including labor, tools, etc… incidental thereto including the formation of construction joints (whether shown on the Drawings or not) holes, ducts, pockets, sockets, form oil and the like not exceeding 0.15 cubic meter each in volume; individual fillets, chamfers, splays, drips, rebates, recesses, grooves and the like of 100 mm total girth or less when measured over all the faces in contact with the concrete, the edges of blinding concrete 75mm or less in thickness and unformed surfaces.

Section 12 - Fencing

12.1 Scope of Work

12.1.1 The work under this Section to be carried out by the Contractor consists of the execution and completion of Fencing as shown on the Drawings.

12.1.2 Prior to commencement of the Fencing the Contractor shall obtain the approval of the Engineer on the equipment and materials to be used and the methods of work execution. No materials shall be used or installed until the Contractor has been notified by the Engineer of his approval.

12.1.3 Fencing shall include the provision of foundations, boundary walling and railings and gates, all as shown on the Drawings or as directed by the Engineer and as specified herein.

12.1.4 All works shall be in accordance with the strength, location, dimension, line, elevation and finish designated in the Drawings and as specified herein.

12.2 General Design Requirements

Fencing shall comply generally with the relevant provisions of BS 1722.

12.3 Material Requirement

12.3.1 Types Generally

Fencing shall be as indicated on the Drawings, namely: chain link mesh on steel frames, 3.0 m overall height from ground level and with cranked extension poles approximately 400 mm girth with 3 stretched barbed wire strands.

12.3.2 Chain Link Fence

1) Chain link fence shall be zinc galvanized steel wire PVC covered, interlocking, heavy duty type, of a type and from a manufacturer to be approved by the Engineer.
2) Size of chain link mesh shall be 5 cm x 5 cm, and steel wire shall be 4 mm in diameter.
3) Width of manufactured roll shall be 2m or adjusted to suit the height of the fabricated panels. Cutting at top or bottom will not be allowed.
4) Chain link fencing shall include approved type screw or clamp fixings to securely fix fencing to framing, without damaging the PVC covered chain link or the galvanising of the frame.

12.3.3 Barbed Wire

1) Barbed wire shall be hot dip zinc galvanised barbed wire and shall consist of 2-ply twisted steel wire, each ply being 2.5 mm diameter, meeting the requirements of BS4102 or JIS G 3533. Barbs shall be spaced approximately 10 cm apart.
2) 3 strands of barbed wire shall be provided to top of Chain Link Fences as shown on the Drawings
3) Barbed wire shall include approved type screw or clamp fixings to securely fix fencing to framing, without damaging the galvanising of the frame. If frames are drilled to allow barbed wire to pass through, then frames shall be galvanized after drilling.

12.3.4 Posts and Framing to Chain Link Fencing

1) Posts and framing shall be constructed of structural steel section or pipes as indicated on the Drawings.

2) Structural steel section shall conform to JIS G3101

3) Structural steel pipe shall conform to JIS G43444.

4) All open ends of pipe sections shall be capped with welded plate.

5) All surfaces of steel sections and pipes and all fittings shall be hot dip zinc galvanized; 550 g/m^2; after fabrication and finished with paint.

6) Paint finish shall be:-

First coat : Epoxy primer 50μ
Second coat : Synthetic rubber paint 35μ
Finish coat : Synthetic rubber paint 30μ

7) Galvanizing and painting shall be performed at factory. Steel surfaces shall be cleaned of rust or other foreign substances by sand blast, shot blast or similar mechanical means before galvanizing.

12.3.5 Posts to Post and Wire Fencing

1) Posts shall be cast in place concrete reinforced reinforcing steel bars as shown on the Drawings.

2) Concrete shall be Class C

3) Finish shall be Class F3

12.3.6 Fabrication, Welding and Assembly

1) All Chain Link Fencing shall designed by the Contractor to be prefabricated off the Site. Assembly and erection shall be b bolted connections.

2) Welding of steel after galvanising shall not be permitted.

3) Welding shall be continuous and on all sides and faces. No gaps or voids shall be left in the fabricated panel.

12.3.7 Concrete for Foundations

Grade 20 Concrete shall be used in accordance with the Reference Specifications.

12.4 Construction

12.4.1 Clearing Fence and Gate Line

1) The fence line shall be cleared to a minimum of 60 cm on each side of the centreline of the fence.

2) Clearing shall include removal of all stumps, brush, rocks, trees, or other obstructions, which may interfere with the proper construction of the fence. Stumps within cleared area of the fence line shall be grubbed up and removed, all holes remaining shall be back-filled with suitable soil, or other materials acceptable to the Engineer and shall be compacted properly with tampers.

3) The cleared ground surfaces along all fence lines, shall be treated with approved weedkiller prior to completion of the Works.

12.4.2 Installing Posts

1) The posts shall be firmly set in adequate sized concrete foundations.

2) Top of concrete foundations shall be slightly above the ground surface, trowel finished, and sloped to drain away from the posts.

12.4.3 Straining Posts

Diagonal straining posts shall be provided at all changes in direction and at approved centers along the chain link and post and wire fencing.

12.5 Measurement and Rates.

12.5.1 Measurement

Work under this Section shall be measured according to the item classifications and units contained in the Bill of Quantities (BOQ). Unless classified otherwise, the items and units of measurement for Fencing and Gates shall be as follows:-

a. Fencing shall be measured in linear metres (m)

b. Quantities will be computed by measurement on plan along the centreline from the dimensions on the Drawings.

12.5.2 Rates

Rates for fencing shall include for:-

a. Supplying, fabricating and installing the Chain Link Fence including its basement on excavation, backfill, concrete, formwork and reinforcement.

b. Finish painting

c. Clearing and grubbing of all fence lines and treating with herbicide.

Section 13 - Demolition

13.1 Scope of Work

13.1.1 The work under this Section to be carried out by the Contractor consists of the execution and completion of Demolition works to all required areas of the Site.

13.1.2 Demolition shall include the demolition of structures, roads and paving, grubbing up and removal of all foundations and the removal of all resultant waste materials and debris, to permit construction of the Works, all as indicated on the Drawings or as instructed by the Engineer and as specified herein.

13.1.3 Prior to commencement of the demolition work, the Contractor shall obtain the Engineer's written instructions regarding the extent of work, objects that are to remain, approval for the equipment to be used and the method of work execution.

13.1.4 All materials arising from Demolitions shall remain the property of the Employer. Demolition materials generally shall be transported and deposited by the Contractor to locations on the Site or within the Project Area.

13.1.5 Where instructed by the Engineer that materials are not required to be retained by the Employer, materials arising from the demolition works shall be removed by the Contractor from the Site and from the Project Area to a disposal area to be selected by the Contractor, at the expense of the Contractor.

13.2 Demolition Method

13.2.1 General

The work execution methodology referred to above, shall provide for safe conduct of the work, careful removal and disposal of materials, protection of property, which is to remain undisturbed, disconnection and demolition of drains and services.

13.2.2 Dust Control

Dust resulting from demolition shall be controlled to prevent the spread to existing buildings and to avoid nuisance in the surrounding areas.

13.2.3 Existing Utilities

The Contractor shall be fully responsible for determining the extent of existing underground and above ground drainage and utilities which will be demolished and removed or which are to remain. The Contractor shall make allowances in his Bid such work including for the presence of existing utilities not shown in the Drawings.

Pipe cut-offs, shall be permanently plugged with concrete at the locations as directed by the Engineer.

When pipes or cables are encountered that are not indicated in the Drawings, the Engineer shall be notified for further instruction. Due allowance shall be made by the Contractor for this within the unit rates.

13.2.4 Protection of Existing Utilities

Before beginning any cutting or demolition work, the Contractor shall carefully survey the existing work and examine the Drawings and Specifications to determine the extent of the work. The Contractor shall take all necessary precautions to prevent damage to existing work, which is to remain in place, to be reused, or to be handed over to the Employer. Any damage to such work shall be repaired or replaced as approved by the Engineer at no additional cost.

The Contractor shall ensure that existing utilities, pipes, cables and the like not within the Site, are not disturbed, damaged or affected in any manner whatsoever.

13.3 Demolitions of Miscellaneous and Associated structures

13.3.1 Demolition of roads shall include for breaking up and removal of pavement and sub bases to the level directed by the Engineer. The exposed ground surface shall be excavated, levelled and compacted to comply with the requirements of the Engineer. Any excess of volume of demolition shall be compensated by filling with selected material or by increase of thickness of succeeding cement treated sub-base at the expense of the Contractor.

13.3.2 Demolition of drainage ditches, wells and other miscellaneous structures shall include for breaking up and removal of structures to the level directed by the Engineer.

13.3.3 Filling voids to the new formation level left by the demolition of these items shall be by methods and with materials all to be approved by the Engineer and this shall be understood to be included with the item.

13.4 Measurement and Rates.

13.4.1 Measurement

Measurement is not applicable for the work. The payment of the work is stipulated in the Bill of Quantities with lump sum price.

13.4.2 Rates/Sums

Rates/sums for Demolitions shall include for:-

(i) Demolishing buildings and structures complete with all ground slabs and foundations or to a level and dimensions as instructed by the Engineer sufficient to accommodate the new works.

(ii) Disposal of all Demolition material as instructed by the Engineer, either to a location on Site or within the Project Area to be designated by the Employer for items to be retained, or removed offsite to a suitable location selected by the Contractor outside the Project Area.

(iii) Demolishing paved areas to underside of surface paving or sub-bases as instructed by the Engineer and including the demolition of areas of differing thickness, all associated curbs, channels and attached foundations.

(iv) All work to existing drains or utilities including protection, sealing, removing, or diverting, where affected by the Demolition work.

(v) Saw cutting at limits or other required measures to ensure clean working limits and to avoid any over breaking or damage to surrounding or adjacent surfaces or structures.

(vi) Replacing, repairing and making good any damage to surrounding or adjacent surfaces, sub-surfaces or structures, beyond the limits of Demolition.

Section 14 – Clearing and Grubbing

14.1 Scope of Work

14.1.1 The work under this Section to be carried out by the Contractor, consists of the execution and completion of the Clearing and Grubbing to all required areas of the Site.

14.1.2 Clearing and grubbing shall include the removal from ground surfaces and grubbing up of roots and miscellaneous foundations of all dense vegetation, bushes, trees, hedges, fences, obstructions and the like together with the removal and disposal off the Site and off the Project Area, of all materials and waste arising there from, all as indicated on the Drawings or as instructed by the Engineer and as specified herein.

14.1.3 Prior to commencement of the clearing and grubbing work, the Contractor shall obtain the Engineer's written instructions regarding the extent of work, objects that are to remain, approval for the equipment to be used and the method of work execution.

14.1.4 All materials arising from Clearing and Grubbing shall remain the property of the Employer. Clearing and Grubbing materials generally shall be disposed of by transported and deposited by the Contractor to locations on the Site or within the Project Area.

14.1.5 Where instructed by the Engineer that materials are not required to be retained by the Employer, materials shall be removed by the Contractor from the Site and from the Project Area to a disposal area to be selected by the Contractor, at the expense of the Contractor.

14.2 Construction Requirements

14.2.1 In areas where clearing and grubbing is instructed by the Engineer, the Contractor shall clear the ground surface of all trees, stumps, logs, bush, undergrowth, hedges, fences, structures, debris and rubbish of any nature, including the removal of stumps, roots, road areas, slabs and structural foundations where affected by the Works. Due care must be taken not to damage trees and existing structures outside the limits of the working area or identified as to remain.

14.2.2 Where necessary, and as directed by the Engineer, voids resulting from clearing and grubbing operations shall be filled with suitable compacted material at the Contractor’s expense.

14.3 Measurement and Rates

14.3.1 Measurement

1) Work under this Section, shall be measured according to the item classifications and units contained in the Bill of Quantities (BOQ). Unless classified otherwise, Clearing and grubbing shall be measured in square metres (m^2) to the particular locations and areas requiring this operation as instructed by the Engineer on Site
2) The area shall be measured by survey on Site or from the Drawings.

14.3.2 Rates/Sums

The rates for Clearing and Grubbing shall include for segregation, removal and disposal of all resultant debris and waste in the Site.

Section 15 - Metal Work

15.1 General

15.1.1 Scope

This Section covers the general requirements for designing, manufacturing, transporting, installing, coating and other common requirements incidental to all metal work to be furnished under the Contract.

The metal works herein specified shall mean steel works such as ladder rungs with safe guird, fabricated concrete manhole covers with handle made by sus, steel balustrades, etc. as shown on the Drawings or as directed by the Engineer.

The provisions of Clauses 5.1 and 5.2 shall apply to all metalwork furnished under the Contract.

15.1.2 Submittals

The Contractor shall prepare Shop Drawings showing complete details, sections and plans of all parts, assemblies, materials lists, components, connections and supports, and relations to the structures based on the Drawings. The shop Drawings are subject to approval by the Engineer.

15.1.3 Standards

Unless otherwise specifically provided in this Specification, the metal works shall be manufactured, fabricated and installed in accordance with the latest provisions of JIS, or other equivalent standards approved by the Engineer. All materials to be furnished by the Contractor shall be new and shall have the best quality of their respective kinds. Unless otherwise specified in this Specification, all materials and methods of fabrication shall conform to the standards listed in the following table.

Standards for Metalwork

Item	Standard
Structural Steel	ASTM A36, JIS G3101 or JIS G3106
Structural Steel Pipe Steel Pipe	ASTM 120 or JIS G3444 JISG3452
Bolt and Nut	ASTM A307 Grade A or JIS B1180
Arc Welding Electrode	AWS, JIS Z3211
Hollow Steel Sections	JIS 3466

15.2 Fabrication and construction

15.2.1 General

The Contractor shall be responsible for the correctness and completeness of the shop Drawings and for shop fit and field connections. The work shall be shop-fitted and shop-assembled where practicable, conforming to the details on the approved shop Drawings.

Where necessary, metals shall be insulated to prevent electrolysis due to contact between dissimilar metals and to prevent corrosion due to contact between metals and masonry or concrete. Insulation shall be by means of bituminous paint or other approved means.

All fastening, anchors and accessories required for fabrication and erection shall be provided by the Contractor. Exposed fastenings shall be kept to an absolute minimum, evenly spaced and neatly set out. Wood plugs will not be permitted. Workmanship in fabrication shall conform to the best modern shop and field practice. All joints and intersecting members shall be accurately fitted and all works shall be fabricated on true planes with adequate fastenings.

15.2.2 Welding

All welding shall be in accordance with the requirements of Section 16 Welding, and as specified below. All welds shall be visually inspected by the Engineer and shall be subject to his approval. When the Engineer directed, welds shall be tested by radiographic tests specified in JIS 3104 or other testing method approved by the Engineer.

Field welding shall not normally be permitted. However, when expressly authorized by the Engineer it shall not be performed under adverse weather conditions of rain, temperature, moisture and wind unless the welding work is protected in a manner approved by the Engineer.

Welds disapproved by the Engineer shall be chipped out to sound metal, tested and repair-welded and subject to the Engineer's approval using a procedure approved by the Engineer prior to carrying out the repair.

15.2.3 Protective Treatment of Metalwork

All minor metalwork shall be hot dip galvanized in accordance with the requirements of this Clause.

a. Galvanizing of steel, where required, shall be at a rate of 0.6 kilograms per square meter and shall be performed in accordance with ASTM A123, JIS H8641, or equivalent.

b. In metal work which is to be galvanized:

c. After fabrication, all joints which are not already welded shall be seal-welded; and

d. Tapped holes shall be tapped slightly oversize and tapped again to the correct size after galvanizing.

e. For galvanized metal for handrails, ladders and fence, red lead prime painting will not be required except for weld joints, and one coat of approved paint shall be applied.

f. Where painting is called for, galvanized metal surfaces shall be acidetched prior to the application of the finishing surface coats.

g. If painting is required, the Contractor shall submit a proposal of a painting system for the Engineer's approval.

15.2.4 Check Sheets

At least seven (7) days before placing concrete in any structure or installing any metal work, the Contractor shall submit, for approval, three (3) copies of an approved checkout sheet detailing all items of metalwork to be installed including unit masses and dimensions for materials to be furnished and installed and receipted invoices or other approved documentary evidence detailing the mass of any item which has been furnished and installed.

15.2.5 Installation

Metal works to be embedded in concrete shall be embedded when the concrete is being placed or, if shown on the Drawings or directed by the Engineer, recesses or block-outs shall be made in the concrete and the metalwork shall be grouted in place using cement or embedded in second stage concrete.

The surfaces of all metal works to be in contact with concrete shall be thoroughly cleaned immediately before the grout or concrete is placed.

Metal works shall be accurately positioned and aligned in the locations as shown on the Drawings, and shall be held securely in the correct position during placing and setting of the concrete.

Where it is impracticable to place anchors or anchor bolts required for the installation of

metal work when the concrete is placed, holes shall be drilled into the concrete after the concrete has set for 28 days and expansion bolts, adhesive anchor bolts, or other approved anchors shall be installed.

Field welding, cutting or drilling of prefabricated galvanized metalwork items shall not be permitted without the written approval of the Engineer.

15.3 Ladder rungs and safe guard

Ladder rungs and safe guard shall be fabricated to the size and dimensions as shown on the Drawings. Ladder rungs and safe guard shall be installed accurately to the lines and spacing shown on the Drawings in the walls of manholes.

All materials, workmanship, coating and installation shall be in accordance with the requirements specified in Clauses 5.1 and 5.2.

15.4 Fabricated manhole covers

Manhole covers made by concrete with handle made by SUS 304 for maintenance in the manhole shall be fabricated to the size and dimensions as shown on the Drawings. Manhole frames shall be accurately installed in the locations as shown on the Drawings. All materials, workmanship, coating and installation shall be in accordance with the requirements specified in Clauses 5.1 and 5.2.

15.5 Steel balustrade

The Contractor shall provide steel balustrades made by SUS in accordance with the details and at the locations shown on the Drawings or as directed by the Engineer. Units of balustrade shall be fabricated in units such that the need for site welding is minimal. All materials, workmanship, coating and installation shall be in accordance with the requirements specified in Clauses 5.1 and 5.2.

15.6 Measurement and payment

15.6.1 Ladder Rungs

Measurement shall be made of the number of ladder rungs completed and installed and approved by the Engineer. Payment shall be made at the rate entered in the priced Bill of Quantities which shall be full compensation for the cost of all materials, labor, equipment and incidental costs for completing ladder rungs in accordance with the Drawings and the Specification.

15.6.2 Fabricated Manhole Covers

Measurement shall be made of the mass of fabricated concrete manhole covers completed and installed and approved by the Engineer. Measurement of the mass may be made by calculation or by weighing at the discretion of the Engineer.

Payment shall be made at the rate entered in the priced Bill of Quantities which shall be full compensation for the cost of all materials, labor, equipment and incidental costs for completing the fabricated manhole covers in accordance with the Drawings and the Specification. The rate shall specifically include the cost of installation including the cost mortar bedding.

15.8.3 Other Metalwork Items

Measurement for payment shall be made of the masses of the respective metalwork items. Measurement may be made by calculation or by weighing at the Engineer's discretion.

Payment shall be made at the respective rates entered in the priced Bill of Quantities which shall be full compensation for the cost of all materials, labor, equipment and incidental costs for completing the metalwork item in accordance with the Drawings and the Specification. The rates shall specifically include the cost of installation including the cost of any mortar or secondary concrete or fixings required for installation.

Section 16 - Welding

16.1 General

All welding shall be done either manually by the shielded metallic arc process or automatically by the shielded arc or submerged arc method.

The Contractor shall submit a welding procedure for the approval of the Engineer in the same manner as the drawings. After the welding procedure has been approved, the Contractor shall record it in the operation and maintenance instructions. Welding sizes and types shall be shown on all Contractor's drawings where welding is required.

Plates to be joined by welding shall be accurately cut to size and rolled bypressure to the proper curvature, which shall be continuous from the edge. Plattering in the curvature along the edges with correction by blows will not be allowed. The dimensions and shape of the edges to be joined shall be such as to allow thorough fusion and complete penetration and the edges of plates shall be properly formed to accommodate the various welding conditions. The surfaces of the plates for a distance of 25 mm from the edge to be welded shall be thoroughly cleaned of all rust, grease and scale, to bright metal.

16.2 Qualification of welding procedure

The technique of welding employed, the appearance and quality of the welds made and the methods used in correcting defective work, shall conform to the American Welding Society (AWS) standard D.I.I, or other approved equivalent standard.

16.3 Qualification of Welders and Welding operators

All welders and welding operators assigned to the works shall have passeda qualification test, within the preceding six months, for welders and welding operators, in accordance with JIS Z 3801 or equivalent. The Contractor shall furnish the Engineer with three (3) certified copied of report of the results of physical tests to the Engineer. If the work of any welder at any time appears questionable, he shall be required to pass the appropriate re-qualification test. All costs of qualification tests shall be borne by the Contractor.

16.4 Welding Electrodes

The welding electrodes shall conform to JIS Z 3211 or 3212, low hydrogen type covering or equivalent.

Stainless type weld metal, where used in the water passages for protection against pitting, shall be of chromium nickel steel. The type, chemical composition and JIS or approved standard number of welding rods used for this purpose shall be subject to the approval of the Engineer